/document title/ titre du document

SCIAMACHY

Bi-Monthly Report:

July - August 2010

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reference/*réference* ENVI-SPPA-EOPG-TN-10-0033
issue/*édition* 1.1
revision/*révision* 0
date of issue/*date d'édition* 03 November 2010
status/*état*
Document type/*type de document* Technical Note
Distribution/*distribution*

APPROVAL

Title *titre*	SCIAMACHY Bi-Monthly Report: July - August 2010	issue *issue* 1.1	revision *revision* 0
author *auteur*	Gabriele Brizzi, IDEAS-SERCO, Angelika Dehn, IDEAS-SERCO, Manfred Gottwald, SOST-DLR, Stefan Noël, SOST-IFE, Richard von Hees, SRON	date *date*	30/09/2010
approved by *approuvé by*	T. Fehr ESA/ESRIN, D/EOP-GQ	date *date*	30/09/2010

CHANGE LOG

reason for change */raison du changement*	issue/*issue*	revision/*revision*	date/*date*
Incorrect reference to section 4 on page 25.	1.1		03/11/2010
Replaced July and August column density and VMR maps due to missing Level 2 off-line products during previous plots generation.	1.1		03/11/2010

CHANGE RECORD

Issue: 1 Revision: 0

reason for change/*raison du changement*	page(s)/*page(s)*	paragraph(s)/*paragraph(s)*
Incorrect reference to section 4	Page 25	
Replaced July and August column density and VMR maps due to missing Level 2 off-line products during previous plots generation.	Figures from 8.1 to 8.40	

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BI-MONTHLY REPORT
JULY - AUGUST 2010

1 INTRODUCTION

The SCIAMACHY Bi-Monthly report documents the current status and recent changes to the SCIAMACHY instrument, its data processing chain, and its data products.
The Bi-Monthly Report (hereafter BMR) is composed of analysis results obtained by IDEAS, combined with inputs received from the different groups working on SCIAMACHY operation, calibration, product validation and data quality.
The first part of the report is dedicated to Instrument Configuration and Performance. It is composed of contributions from SOST-DLR, SOST-IFE and SRON. The remainder of the report is dedicated to Level 1b and Level 2 performance assessment and is generated by ESA/ESRIN IDEAS with contributions from ESA/ESTEC PLSO and DLR-IMF.

The structure of the report will be in constant evolution through the ENVISAT mission, as experience with SCIAMACHY data and quality control grows.

1.1 Scope

The main objective of the BMR is to give, on a regular basis, the status of SCIAMACHY instrument performance, data acquisition, results of anomaly investigations, calibration activities and validation campaigns.

The BMR is composed of the following six sections:

- Summary;
- Instrument Configuration and Performance;
- Degradation monitoring and correction;
- Data Availability Statistics;
- Level 1 Product Quality Monitoring;
- Level 2 NRT and OFL Product Quality Monitoring;
- Validation Activities and Results.

1.2 References

[1] 'Instrument Operation Manual', MA-SCIA-0000DO/01, Issue F R2, 16 Dec. 2004.
[2] 'ENVISAT-1 Products Specifications Volume 15: SCIAMACHY Products Specifications', PO-RS-MDA-GS-2009, Issue 3L version 1.1, 21 January 2010.
[3] 'SCIAMACHY cL0 Statistics', PO-TN-DLR-SH-0012, Issue 1, Rev. 1, 14 April 2005.
[4] SCIAMACHY cL0 Statistics 2003, PO-TN-DLR-SH-0013, Issue 1, Rev. 0, 14 April 2005.
[5] 'SCIAMACHY Consolidated Level 0: Statistics for the Year 2005', PO-TN-DLR-SH-0014, Issue 1, Rev. 0, 11 July 2006.
[6] 'Summary of the Atmospheric Chemistry Instrument Validation results as presented at the ACVE-3 Workshop', Paul Snoeij, Ankie Piters, Herbert Fischer, Yasjka Meijer, Jean-Christopher Lambert, Thorsten Fehr.
[7] 'SCIAMACHY Extra Misalignment Model', PO-TN-DLR-SH-0016 Issue 1, M. Gottwald, E. Krieg, DLR-IMF, C. von Savigny, S. Noël, K. Bramstedt IUP-IFE, 07 March 2007.
[8] 'Verification of the extra misalignment correction in the SCIAMACHY IPF 6.03 processor', TN-IUP/IFE-2007-cvs-02, C. von Savigny, A. Dehn, H. Bovensmann, J. Steinwagner IUP-IFE, 05 July 2007.
[9] 'SCIAMACHY SciCal Tool Change of Leakage ADF generation' ENV-TN-DLR-SCIA-0094, Issue 1.0, Bernd Aberle, Günter Lichtenberg, 08 November 2007.

1.3 Acronyms and Abbreviations

ADC	Analogue to Digital Converter
ADF	Auxiliary Data File
ANX	Ascending Node Crossing
AOCS	Attitude and Orbit Control System
APSM	Aperture Stop Mechanism
ASM	Azimuth Scan Mechanism
ATC	Active Thermal Control
BMR	Bi-Monthly Report
CA	Corrective Action
CCA	Communication Area
CTI	Configurable Transfer Item
DAC	Digital Analogue Converter
DLR-IMF	Deutsches Zentrum fuer Luft- und Raumfahrt
EOL	End of Life
ESM	Elevation Scan Mechanism
FAT	Factory Acceptance Test
FPN	Fixed Pattern Noise
HK	Housekeeping
HSM	High Speed Multiplexer
ICE	Instrument Control Electronics
ICU	Instrument Control Unit
IDEAS	Instrument Data quality Evaluation and Analysis Service
IECF	Instrument Engineering and Calibration Facilities
IOM	Instrument Operation Manual
LK1	Leakage Current Auxiliary File (SCI_LK1_AX)
LLI	Life Limited Item
LOS	Line of Sight
MCMD	Macro Command
MPH	Main Product Header
MPS	Mission Planning Schedule
NCWM	Nadir Calibration Window Mechanism
NDFM	Neutral Density Filter Mechanism
NIVR	Netherlands Agency for Aerospace Programmes
NNDEC	Non-nominal Decontamination
NRT	Near Real Time
OAR	Observation Anomaly Report
OBM	Optical Bench Module
OCM	Orbit Control manoeuvre
OCR	Operations Change Request
OFL	Off-line
OSDF	Orbit Sequence Definition File
OSV	Orbit State Vector

PCF	Product Control Facility
PDHS	Payload Data Handling Station (PDS)
PDHS-E	Payload Data Handling Station – ESRIN
PDHS-K	Payload Data Handling Station – Kiruna
PDS	Payload Data Segment
PE1	Pixel to Pixel/ Etalon Auxiliary File (SCI_PE1_AX)
PLSO	Payload Switch OFF
PMD	Polarization Measurement Device
QUADAS	Quality Analysis of Data from Atmospheric Sounders
QWG	Quality Working Group
SAA	South Atlantic Anomaly
SCIAMACHY	Scanning Imaging Absorption Spectrometer for Atmospheric Chartography
SCIAVALIG	SCIAMACHY Validation and Interpretation Group
SCICAL	SCIAMACHY Calibration tool
SEU	Single Event Upset
SLS	Spectral Line Source
SM	Service Module
SMR	Sun Mean Reference
SOST	SCIAMACHY Operations Support Team
SP1	Spectral Calibration Auxiliary File (SCI_SP1_AX)
SU1	Sun Reference Auxiliary File (SCI_SU1_AX)
SZA	Sun Zenith Angle
TC	Thermal Control
TCFoV	Total Clear Field of View
TOA	Top of Atmosphere
TRUE	Tangent height Retrieval by UV-B Exploitation
VCD	Vertical Column Density
WLS	White Light Source
WUR	Wageningen University and Research
YSM	Yaw Steering Mode

2 SUMMARY

- Starting from 22 October 2010 the ENVISAT satellite will be placed in a new orbit, 17.4 km lower than the original one. The new orbit will be characterized by a different repeating cycle, going from the actual 35 days/501 orbits to 30/431. Between 22 and 26 October SCIAMACHY will be in MEASUREMENT IDLE mode. During this period some data will be acquired and will be available for the ESA internal verification. Users are invited to discard such data as they are provided without proven data quality and are mainly intended for expert users' data assessment. The nominal data distribution will be resumed on November 2, 2010 More details are available at
  http://earth.esa.int/object/index.cfm?fobjectid=7223

- In the SCIAMACHY Level 1b reprocessed data set generated with processor version 7.03 for the full-mission, data gaps were discovered for the period between 22/10/2003 and 29/02/2004. About 1700 SCIAMACHY Level 0 products for years 2003 and 2004 were found not reprocessed and the corresponding Level 1b products missing on the D-PAC archive. Reprocessing of the missing orbits was performed and the resulting products uploaded.

- The reprocessing of the consolidated SCIAMACHY Level 2 data for the full-mission with the new processor version 5.01 was commenced at D-PAC end July 2010 and was interrupted begin of September 2010. Decision for the interruption was brought by the low quality of the SO2 anthropogenic and the CO column densities contained in SCIAMACHY Level 2 version 5.01 products. Usage of these two retrieved data sets is not recommended with the current implementation. Solutions for the SO2 product's deficiencies are being investigated and corrective actions for the CO improvement are currently on-going. Once implemented and verified, the reprocessing will be restarted. The Level 2 reprocessed data set (SCI_OL__2PU) currently available is for the time range from 02 August 2002 to August 2004.

- A first validation meeting organised by SCIAVALIG was held on 06-07 September 2010 at BIRA (Brussels) discussing the quality of the data from the Level 1b version 7.03 and the Level 2 version 5.01 new processors. In general, the comparison showed good agreement of the SCIAMACHY products with reference algorithms and the available ground based validation data. Clear improvements were identified for the Ozone limb profiles while the new products, BrO, water vapour, OClO and volcanic SO_2 columns, as well as BrO profiles and Limb clouds were considered of good or at least sufficient good quality to be distributed to the user community. The Product Quality Disclaimers, describing data quality and known issues, will be soon updated with the results from the validation activity.

- For the reporting period (orbits 43572 – 44459) SCIAMACHY measurements were nominal with respect to planning.

- Monthly Calibration was regularly performed during orbits:

  - 43926-43930 (25/26-Jul-2010)
  - 44355-44359 (24/25-Aug-2010)

- Occultation measurements with the moon rising on night side were executed between orbits:

  - 44340-44357 (23/24-Aug-2010)

- During the reporting period three OCRs (i.e. 44, 45 and 47) were successfully implemented (details at page 13).

- No TC adjustments were required.

- In this issue of the Bi-Monthly report, global maps of the mean error associated to the column density values obtained from Nadir measurements are plotted as absolute errors instead of relative errors for all Nadir products except total Ozone.

- SCIAMACHY instrument performances and products' quality are checked on a daily basis, monitoring the operational data processing chains. Results are presented by means of Daily Reports published on-line.

  The Level 0 NRT daily reports can be accessed at the following address:
  http://earth.eo.esa.int/pcs/envisat/sciamachy/reports/daily/Level_0/

  The NRT and OFL Level 1b daily reports can be accessed at:
  http://earth.eo.esa.int/pcs/envisat/sciamachy/reports/daily/Level_1/

  The Fast-Delivery and OFL Level 2 daily reports can be accessed at:
  http://earth.eo.esa.int/pcs/envisat/sciamachy/reports/daily/Level_2/

  Starting from April 2010 the monitoring of the SCIAMACHY Level 1b Source Packets has been introduced in the daily inspections performed on the consolidated SCIAMACHY Level 1b products. Average spectra for selected mode-state-cluster (-height) combinations are inspected after calibration with the SciaL1c tool. The daily reports can be accessed at:
  http://earth.eo.esa.int/pcs/envisat/sciamachy/reports/daily/Level_1SP/

- A web-page reporting anomalies in the SCIAMACHY data production is available at: http://earth.eo.esa.int/pcs/envisat/sciamachy/reports/anomalies/

- During the reporting period, two SCIAMACHY consolidated Level 1b products, generated for the SCIAMACHY full-mission reprocessing campaign with IPF 7.03, were found corrupted in the D-PAC FTP server (account scia1usr) with file sizes different from the values indicated in the MPHs. The corrupted products (orbits 17952 and 17957) were removed from the FTP server and reprocessed.

- The Level 1b product for orbit 34327 (version 7.03) resulted corrupted in the D-PAC FTP server for an incomplete upload. The complete product is now available.

3 INSTRUMENT CONFIGURATION AND PERFORMANCE

3.1 In-Flight Status and Performance

Detailed operations, planning and instrument status information can be found on the website of the *SCIAMACHY Operations Support (SOST)* under http://atmos.caf.dlr.de/projects/scops/. These pages are maintained on a daily basis and show the history and actual progress of the SCIAMACHY mission.

3.1.1 Planned Operations and Measurements (SOST-DLR)

The reporting period covers the orbits 43572 (ANX = 01-Jul-2010, 00:37:34.262) to 44459 (ANX = 31-Aug-2010, 23:48:42.525). Two OSDFs specified the planning baseline.

Orbit		ANX		OSDF
Start	Stop	Start	Stop	
43572	44015	01-Jul-2010 00:37:34.262	31-Jul-2010 23:22:50.429	MPL_OSD_SHVSH_20100519_010101_00000000_35140001_20100701_003736_20100801_010324.N1
44016	44459	01-Aug-2010 01:03:26.358	31-Aug-2010 23:48:42.525	MPL_OSD_SHVSH_20100601_010101_00000000_35150001_20100801_010328_20100901_012916.N1

Table 3-1: SCIAMACHY OSDF planning file from July – August 2010.

Measurements were nominal, i.e. timelines executed limb/nadir sequences with wide swath settings on the dayside of the orbit. Each month they were interleaved with 2 blocks of 14-15 orbits each where the limb state was replaced by the *limb_mesosphere_thermosphere* state (see below). In-flight calibration and monitoring measurements occurred on daily, weekly and monthly timescales according to the mission scenarios. Regular monthly calibration was scheduled between orbits

- 43926-43930 (25/26-Jul-2010)
- 44355-44359 (24/25-Aug-2010)

The moon was in the limb TCFoV between orbits

- 43854-43948 (20-Jul-2010 until 27-Jul-2010)
- 44273-44371 (18-Aug-2010 until 25-Aug-2010)

Occultation measurements with the moon rising on the night side could be executed between orbits

- 44340-44357 (23/24-Aug-2010)

Four blocks of *limb_mesosphere_thermosphere* measurements were scheduled.

Orbit		UTC		Remark
Start	Stop	Start	Stop	
43615	43630	04-Jul-2010 00:43:19	05-Jul-2010 01:52:18	
43815	43830	18-Jul-2010 00:03:04	19-Jul-2010 01:12:03	MIPAS upper atmosphere mode
44044	44059	03-Aug-2010 00:00:12	04-Aug-2010 01:09:11	
44245	44260	17-Aug-2010 01:00:33	18-Aug-2010 02:09:32	MIPAS upper atmosphere mode

Table 3-2: Scheduled *limb_mesosphere_thermosphere* measurements in July – August 2010.

The July/August period was OCR 'high season'. Three OCRs were successfully implemented. These were

- OCR_044 *(Channel 8 anti-saturation)*: Execution included 2 blocks of 3 orbits each. These orbits included ground tracks over African desert areas. The first block occurred in orbits 44091-44093 (06-Aug-2010) and the second was scheduled in orbits 44134-44136 (09-Aug-2010). Due to an instrument anomaly (see below) actual execution of block 2 was in orbits 44134 and 44149/44150 (10-Aug-2010). Because of the large number of required changes a sufficiently long time gap for MCMD upload had to be generated such that no eclipse timeline in the orbits 44090/44093 and 44133/44150 was scheduled. Modified PETs and co-adding factors were uploaded for the duration of the OCR.
- OCR_045 *(extended moon observations)*: This OCR was a repetition of OCR_025 from 2006. Because lunar occultations became again possible in the August visibility period, OCR_045 was split into two parts. The first part was scheduled between orbits 44275-44339 (19-Aug-2010 to 23-Aug-2010) and the second part between orbits 44360-44368 (25-Aug-2010). Because of an instrument and a ground segment anomaly (see below), the planned measurements in orbits 44339 and 44364-44367 were not executed. In OCR_045 the rising moon was observed in nominal scanning mode above the atmosphere from an altitude of about 100 km upwards for a duration of 120 sec.
- OCR_047 *(phytoplankton_permanent)*: The frequently scheduled OCR to increase the spatial resolution for certain clusters in channel 3 (OCRs 032, 035, 039, 041, 042 and 046) was implemented permanently from orbit 44151 onwards (10-Aug-2010).

3.1.2 Instrument Measurement Status (SOST-DLR)

The final flight status for states was changed in response to OCR_047 *(phytoplankton_permanent)*. Co-adding factors in channel 3 were modified as required. Some channel 6 and 7 co-adding factors needed modifications to compensate for the

increased data rate. The new configuration FFS_100810 became operational from orbit 44151 (10-Aug-2010) onwards.

3.1.3 Executed Operations and Measurements (SOST-DLR)

Measurements and instrument availability

The OSDF planning files have been scheduled as requested except for four periods:

- Orbit 43643-43647 (05/06-Jul-2010): A planned orbit control manoeuvre (OCM) required a transfer to MEASUREMENT IDLE. SCIAMACHY measurements started after the OCM with the platform being in *yaw steering mode* only for a few orbits.
- Orbit 44135-44148 (09/10-Aug-2010): SCIAMACHY was transferred to HTR/RF triggered by a Single Event Upset (SEU). Because of this anomaly, execution of two orbits with OCR_044 settings (see above) and permanent implementation of OCR_047 had to be shifted slightly.
- Orbit 44340-44351 (23/24-Apr-2010): SCIAMACHY was transferred to HTR/RF mode triggered by a SEU.
- Orbit 44364-44367 (25-Aug-2010): No measurements were executed between 08:35:47 UTC and 15:21:39 UTC due to missing MCMDs because of a ground segment anomaly.

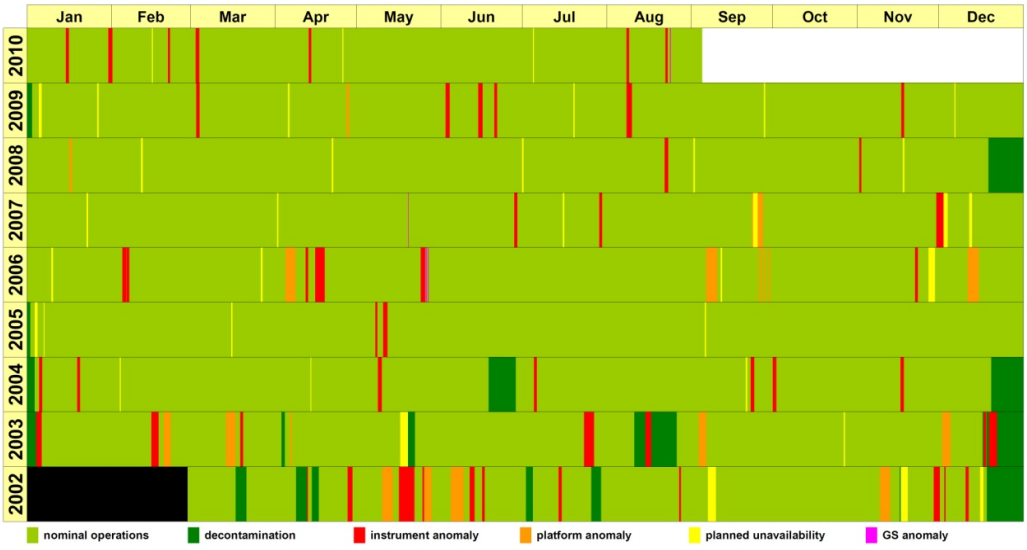


Fig. 3-1: Current instrument availability status including the reporting period.

Detector thermal adjustment (TC)

No TC adjustment was required. The TC settings remained at

- DAC1 = 0.53 W

- DAC2 = 0.50 W
- DAC3 = 0.00 W

APSM/NDFM health checks & PMD ADC cal

In the reporting period 1 APSM/NDFM health check and 2 PMD ADC calibrations were executed. All showed nominal results.

APSM/NDFM			PMD ADC	
Orbit	**ANX**	**Result**	**Orbit**	**ANX**
n.a.	n.a.	n.a.	43962	28-Jul-2010 07:48:15
44376	26-Aug-2010 06:03:05	ok	44377	26-Aug-2010 07:39:35

Table 3-3: APSM/NDFM health check and PMD ADC calibration.

Anomalies

Two instrument anomalies and one ground segment anomaly had occurred.

- Orbit 44135-44148 (09/10-Aug-2010): SCIAMACHY was transferred to HTR/RF triggered by an I0748 parameter out-of-limit (MDI ProcAliveAlarm). A SEU is considered to be the cause of the anomaly.
- Orbit 44340-44351 (23/24-Apr-2010): SCIAMACHY was transferred to HTR/RF mode triggered by a *SDPU_Tx buffer overflow*. A SEU is considered to be the cause of this expected anomaly.
- Orbit 44364-44367 (25-Aug-2010): Due to a ground segment anomaly the MCMDs scheduled for orbits 44364-44367 were not uploaded. Therefore SCIAMACHY remained in MEASUREMENT IDLE mode and no measurements were executed between 08:35:47 UTC and 15:21:39 UTC.
-

Orbit	Date	Entry - UTC	Level	Entry Type	ID Content/Transition	Mode	Remark
44134	09-AUG-2010	2010.221.09.13.17.886	Instrument	AUTONOMOUS SWITCHING	goto HEATER/REFUSE	HTR/RF	MDI ProcAliveAlarm Single Event Upset (SEU)
44134	09-AUG-2010	2010.221.09.13.18.312	Instrument	HK PARAMETER LIMIT EXCEEDING	69 (I0092)	HTR/RF	MDI ProcAliveStatus Single Event Upset (SEU)
44135	09-AUG-2010	2010.221.09.55.13.492	Instrument	MACROCOMMAND EXECUTION ENTRY	START TIMELINE	HTR/RF	Complementary failure
44135	09-AUG-2010	2010.221.09.55.13.500	Instrument	COMPLEMENTARY FAILURES	---	HTR/RF	Complementary failure
44135	09-AUG-2010	2010.221.09.55.13.504	Instrument	MACROCOMMAND EXECUTION ENTRY	START TIMELINE	HTR/RF	Complementary failure
in total 4 Complementary Failures until 2010.221.10.27.05.695							
44136	09-AUG-2010	2010.221.10.27.05.695	Instrument	MACROCOMMAND EXECUTION ENTRY	START TIMELINE	HTR/RF	Complementary failure
44136	09-AUG-2010	2010.221.10.27.05.703	Instrument	COMPLEMENTARY FAILURES	---	HTR/RF	Complementary failure
44136	09-AUG-2010	2010.221.10.27.05.707	Instrument	MACROCOMMAND EXECUTION ENTRY	START TIMELINE	HTR/RF	Complementary failure
44340	23-AUG-2010	2010.235.16.20.26.624	Instrument	AUTONOMOUS SWITCHING	ID 406 / goto HEATER/REFUSE	HTR/RF	SDPU_Tx-Buffer-Overflow Single Event Upset (SEU)
44340	23-AUG-2010	2010.235.16.24.33.745	INSTRUMENT	MACROCOMMAND EXECUTION ENTRY	START TIMELINE	STDBY/REF-I	Complementary Failure
44340	23-AUG-2010	2010.235.16.24.33.752	INSTRUMENT	COMPLEMENTARY FAILURES	---	STDBY/REF-I	Complementary Failure
44340	23-AUG-2010	2010.235.16.24.33.756	INSTRUMENT	MACROCOMMAND EXECUTION ENTRY	START TIMELINE	STDBY/REF-I	Complementary Failure
44340	23-AUG-2010	2010.235.16.30.36.170	INSTRUMENT	MACROCOMMAND EXECUTION ENTRY	START TIMELINE	STDBY/REF-I	Complementary Failure
44340	23-AUG-2010	2010.235.16.30.36.182	INSTRUMENT	COMPLEMENTARY FAILURES	---	STDBY/REF-I	Complementary Failure
44340	23-AUG-2010	2010.235.16.30.36.186	INSTRUMENT	MACROCOMMAND EXECUTION ENTRY	START TIMELINE	STDBY/REF-I	Complementary Failure

Table 3-4: Instrument anomalies between July and August 2010.

Data Quality

Slightly reduced pointing performance was possible for the period after the OCM. All transfers to instrument modes lower than MEASUREMENT affected the stability of the ATC/TC system for a short while as listed in table 3-5.

Orbit		UTC		Event	Affected System
Start	Stop	Start	Stop		
43647	n.a.	06-Jul-2010 07:48:00	n.a.	end OCM period	Line-of-Sight (LoS) possible
44148	44154	10-Aug-2010 07:43:05	10-Aug-2010 16:26:04	recovery from HTR/RF	ATC/TC
44351	44357	24-Aug-2010 11:12:08	24-Aug-2010 2047:37	recovery from HTR/RF	ATC/TC

Table 3-5: Periods with reduced data quality between July and August 2010.

3.1.4 Performance Monitoring - System (SOST-DLR)

Detector and OBM temperatures are monitored according to the requirements of the IOM *[1]*. It requests to ensure that the average temperature per orbit remains within the specified limits.

Detector temperatures

For each detector the average temperatures per orbit are determined from HK telemetry parameters. Fig. 3-2 displays the temperatures of all 8 detectors. Colour coding is as on the operational monitoring website, i.e. data from orbits with HK telemetry coverage > 90% are shown in red, for < 90% in green. Minimum/maximum values per orbit are indicated as vertical bars. The temperature limits of each detector are shown as horizontal lines.

During parts of the reporting period detector 4 and 5 temperatures were above the upper limits. This was tolerated since deviations did not exceed 0.5 K.

OBM temperatures

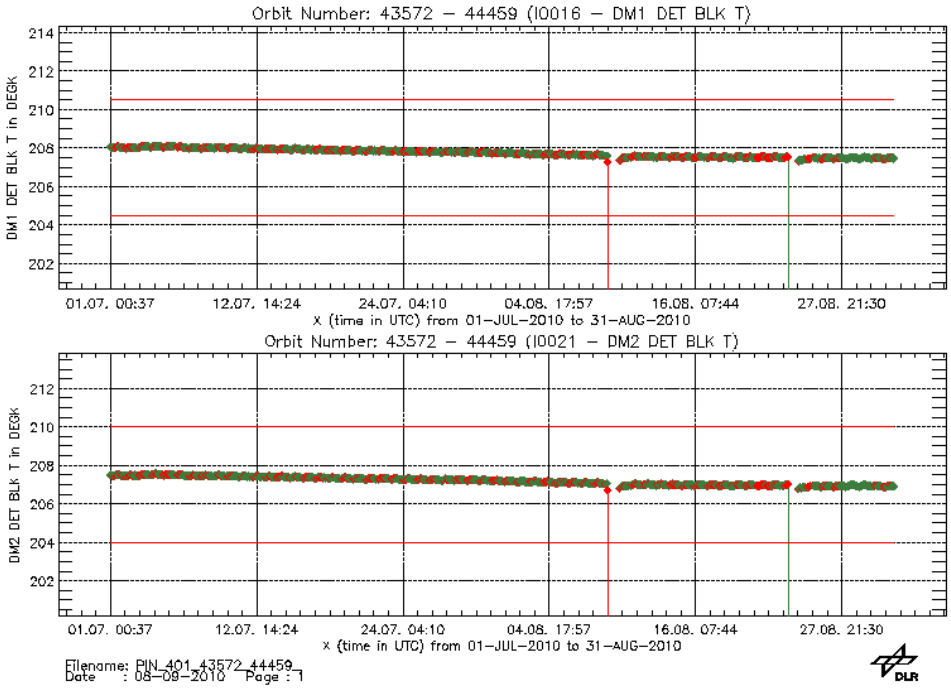
The average OBM temperature per orbit is determined from specific HK telemetry parameters. In addition power readings for the ATC heaters are monitored. Temperatures and ATC heater powers are given in Fig. 3-3 and 3-4. Colour coding is as in Fig. 3-2.

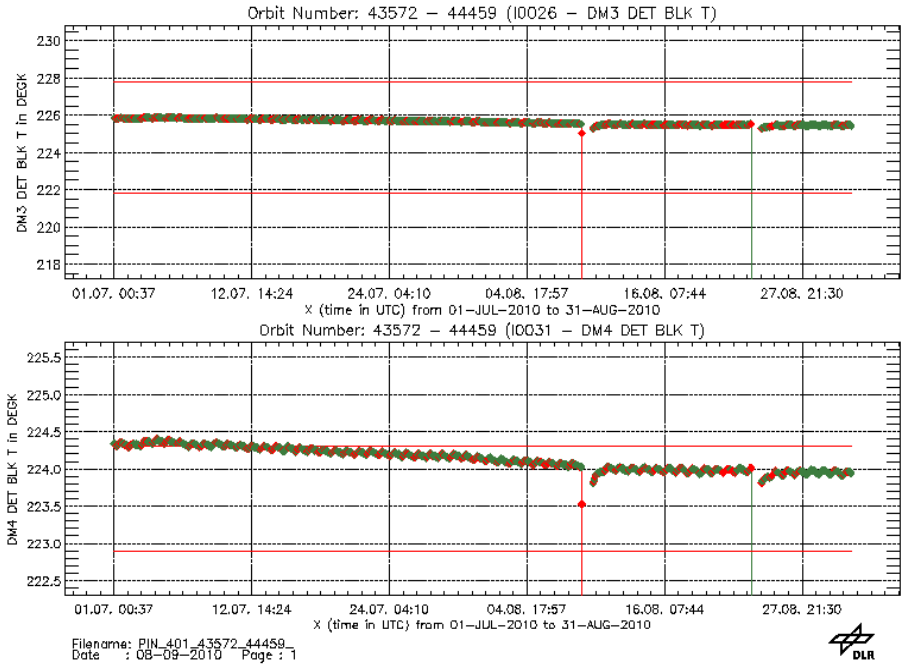
OBM temperatures and ATC heater powers remained within limits during nominal operations.

PMD ADC status

The status of the PMD ADC is monitored according to the requirements of the IOM *[1]*. It requests to ensure that no glitches occur caused by an SEU.

No PMD ADC glitches have been detected.


Orbit Number: 43572 – 44459 (I0016 – DM1 DET BLK T)
DM1 DET BLK T in DEGK
214
212
210
208
206
204
202
01.07. 00:37
12.07. 14:24
24.07. 04:10
04.08. 17:57
16.08. 07:44
27.08. 21:30
X (time in UTC) from 01-JUL-2010 to 31-AUG-2010
Orbit Number: 43572 – 44459 (I0021 – DM2 DET BLK T)
DM2 DET BLK T in DEGK
212
210
208
206
204
202
01.07. 00:37
12.07. 14:24
24.07. 04:10
04.08. 17:57
16.08. 07:44
27.08. 21:30
X (time in UTC) from 01-JUL-2010 to 31-AUG-2010
Filename: PIN_401_43572_44459_
Date : 08-09-2010 Page : 1
DLR


Orbit Number: 43572 – 44459 (I0026 – DM3 DET BLK T)
DM3 DET BLK T in DEGK
230
228
226
224
222
220
218
01.07. 00:37
12.07. 14:24
24.07. 04:10
04.08. 17:57
16.08. 07:44
27.08. 21:30
X (time in UTC) from 01-JUL-2010 to 31-AUG-2010
Orbit Number: 43572 – 44459 (I0031 – DM4 DET BLK T)
DM4 DET BLK T in DEGK
225.5
225.0
224.5
224.0
223.5
223.0
222.5
01.07. 00:37
12.07. 14:24
24.07. 04:10
04.08. 17:57
16.08. 07:44
27.08. 21:30
X (time in UTC) from 01-JUL-2010 to 31-AUG-2010
Filename: PIN_401_43572_44459_
Date : 08-09-2010 Page : 1
DLR

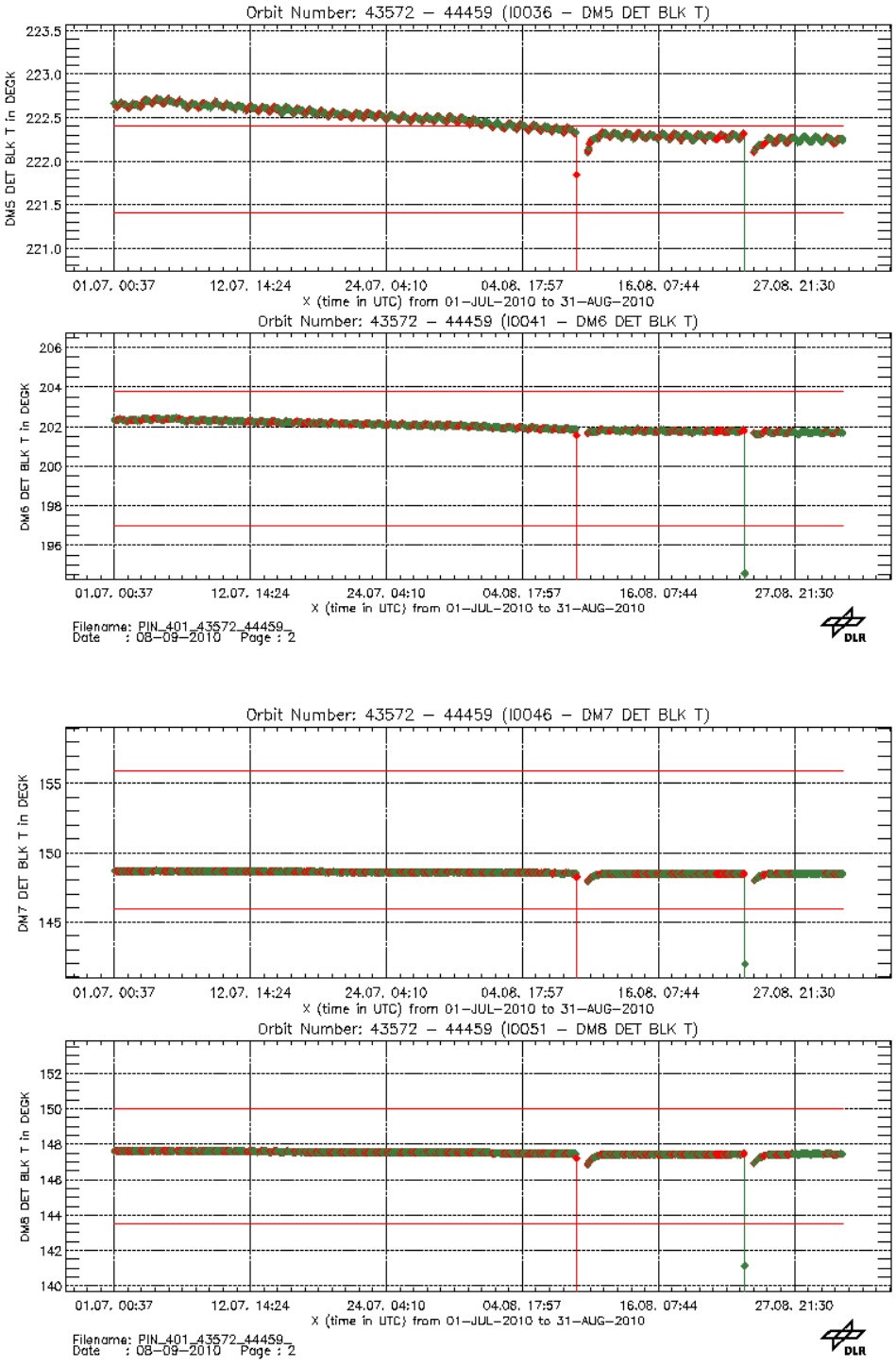


Fig. 3-2: Detector temperatures.

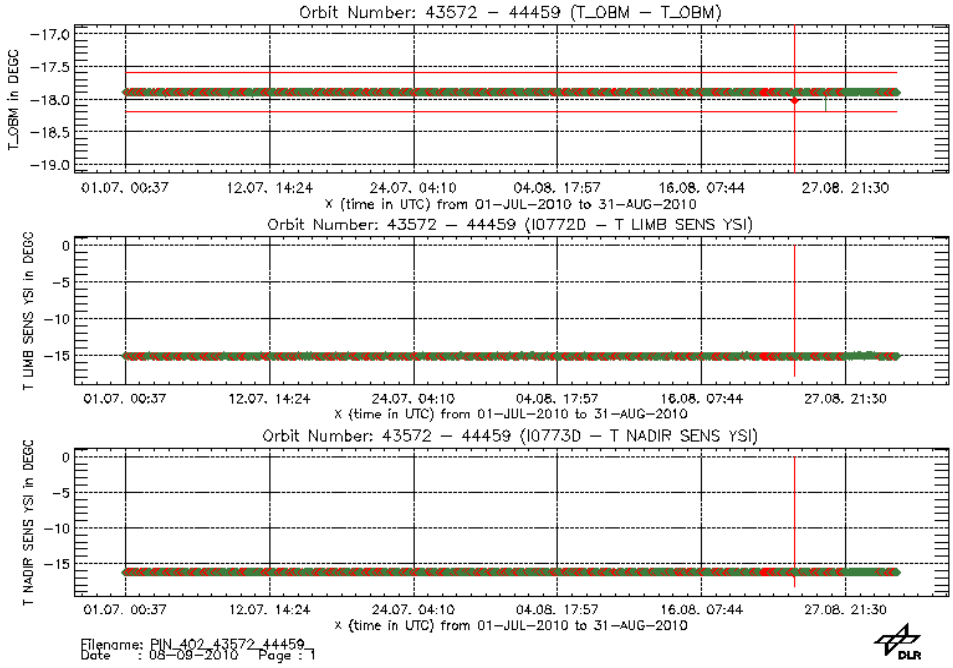


Fig. 3-3: OBM temperatures (top: derived OBM, middle: limb sensor, bottom: nadir sensor).

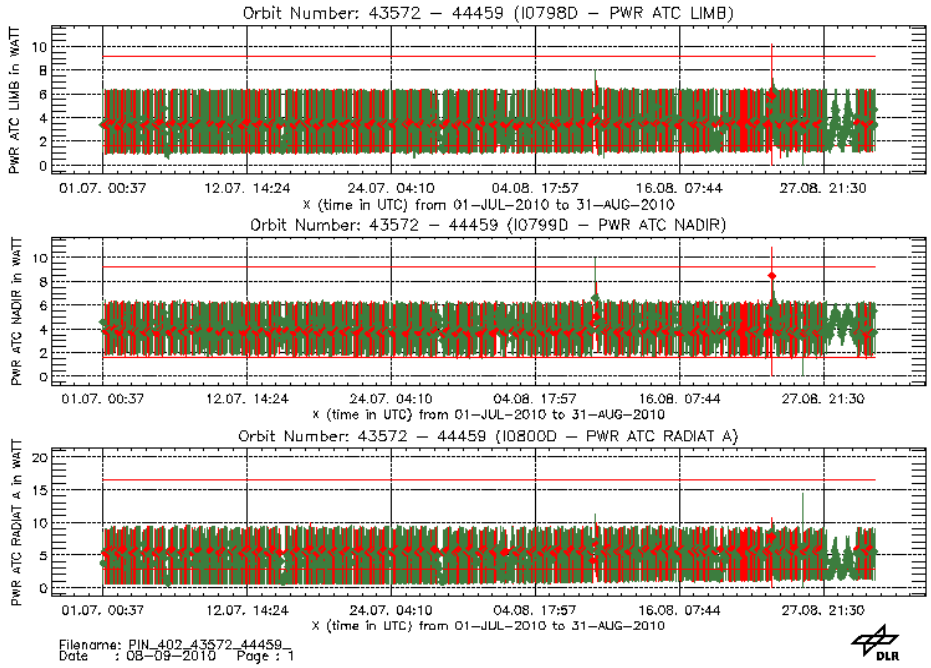


Fig. 3-4: ATC heater power (top: ATC limb, middle: ATC nadir, bottom: ATC Rad A).

LLI status

Life Limited Items are monitored based on analysis of the

- OSDF: This yields a predicted LLI usage.
- Report format: This counts the actual LLI switches or used LLI cycles. No WLS/SLS burning times can be derived thereof.

In addition, the in-flight usage of the cryogenic heat pipe is recorded. This subsystem has a limited number of cycles. Each decontamination increases the accumulated number of cycles by 1.

At the end of the reporting period the fractional usage of the LLI relative to the allowed in-flight budget was (based on OSDF prediction)

- NDFM: 0.57
- APSM: 0.52
- NCWM (sub-solar port): 0.87
- WLS (switches): 0.17
- WLS (burning time): 0.32
- SLS (switches): 0.07
- SLS (burning time): 0.02

For the NDFM and APSM the safety margin factor of 2 is no longer applied in the calculation of the fractional usage since it had been found acceptable to stay below the figures of the life-tests. How the relative LLI usage has accumulated since launch is illustrated in Fig. 3-5. 'EOL' assumes a total mission lifetime until end of 2013.

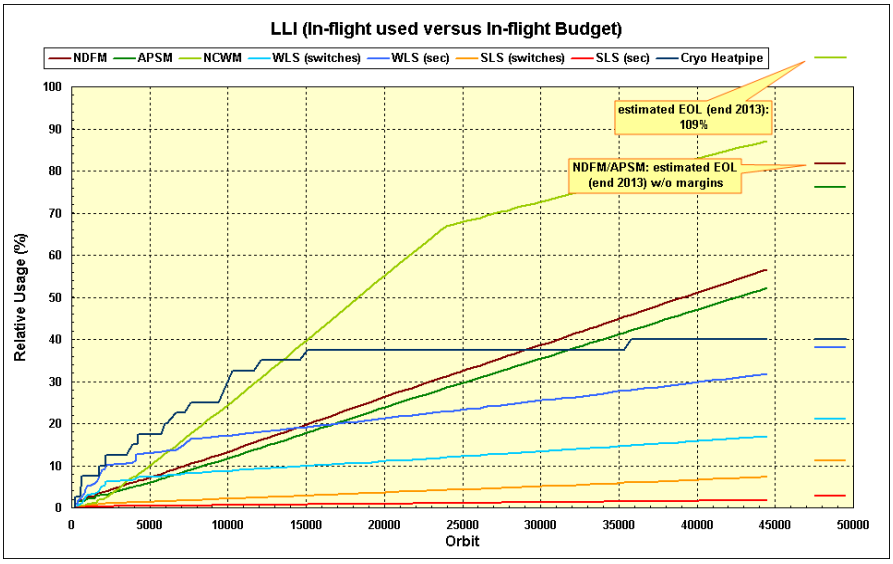


Fig. 3-5: Relative usage of LLIs. 'EOL' is derived for a mission lifetime until 2013. For the NDFM and APSM no margin factors have been applied to derive the EOL relative usage.

Note that the NCWM usage exceeding 100% by the end of 2013 will be adjusted once the second phase of the mission extension has started in 2010.

The number of cryogenic heatpipe cycles did not increase (decontamination was already included in the November-December report). The budget used remained at 40% of the allowed in-flight budget.

Time reference

The times quoted in all planning files refer to the reference orbit. Since the actual orbit differs from the reference orbit (e.g. orbit drift), the times given w.r.t. the reference orbit also do not reflect exactly the actual absolute times of events along the orbit (e.g. ANX, sunrise, sub-solar, moonrise, eclipse). The requirements for orbit maintenance may result in time differences of usually < ±10 sec. In some cases this value may even reach ±1 min, however.

SOST monitors how the reference time deviates from the actual time. This is done by using the predicted time which comes very close to the actual = restituted time. If the predicted times are delayed with respect to the reference orbit, then the difference *predicted – reference time* is > 0 sec; in the other case it is < 0 sec.

Fig. 3-6 displays the time difference *predicted – reference*. Orbit manoeuvres cause distinct discontinuities.

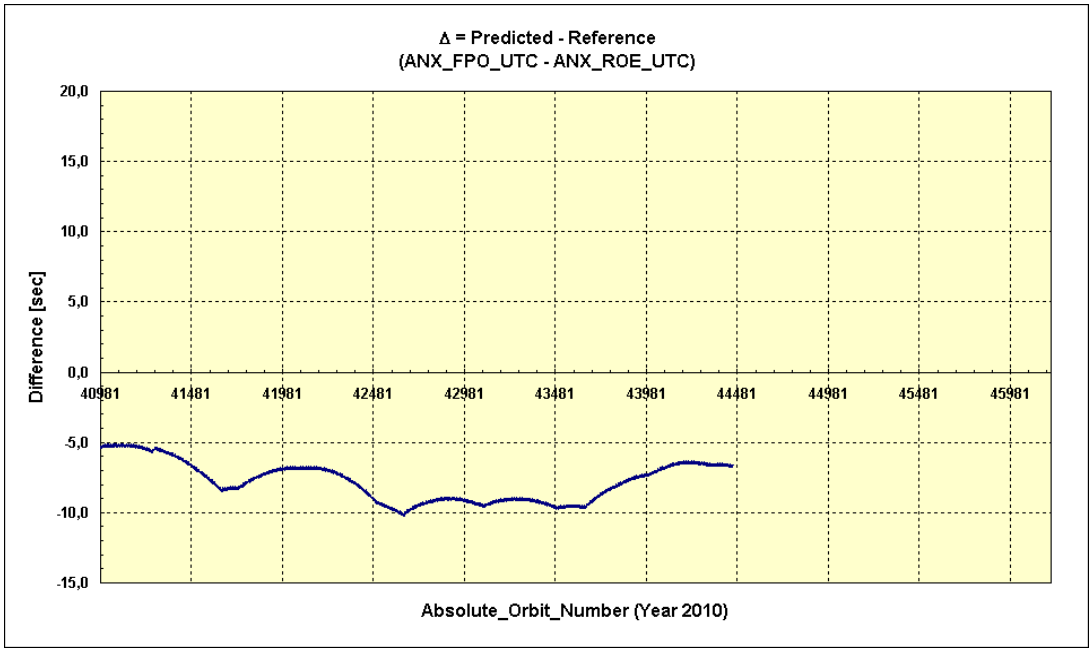


Fig. 3-6: Time difference between predicted and reference time.

3.1.5 Performance Monitoring - Light Path (SOST-IFE)

This section summarises the performance monitoring results for the two months time interval covered by this report.
A more detailed description of the performance monitoring activities is given in the SCIAMACHY Bi-Monthly Report May-June 2008.

3.1.5.1 Science Channel Averages

One part of the SOST long-term monitoring activities is the trend analysis of measurements with the internal White Light Source (WLS) and of observations of the unobscured Sun above the atmosphere. In order to monitor the different SCIAMACHY light paths, solar measurements are taken in various viewing geometries: In limb/occultation geometry (via ASM and ESM mirrors), in nadir geometry (via the ESM mirror through the sub solar port), and via the so-called calibration light path involving the ASM mirror and the ESM diffuser. SCIAMACHY long-term monitoring comprises a regular analysis of these measurements. The plots displayed in Figure 3.7 show results of these monitoring activities for the time interval July to August 2010.
Note that the reported channel averages are medians. The currently used scan angle correction is based on Version 6 radiometric key data.

The light path monitoring results presented in this section may be regarded as a first step towards spectrally resolved monitoring factors (m-factors) which is produced based on fully calibrated data.
Daily updated light path monitoring results can be found on the SOST or IUP web site (http://www.iup.uni-bremen.de/sciamachy/LTM/LTM.html).

The following specific features can be identified from the light path monitoring results during the time interval of this report:

- Overall the instrument behaved as expected.
- Data gaps around 10 and 24 August are caused by two short instrument switch-offs.
- The degradation rate in the UV (channels 1 & 2) remains at about 1% per month.
- The minimum average throughput in channel 1 lies currently around 28% (for the limb light path). The throughput of the calibration light path is currently at about 76% in channel 1 and 79% in channel 2.
- The overall degradation of channel 3 is still very small (2 – 9%, depending on light path) compared to channels 1 and 2. A small decrease in throughput of less than 0.5% is observed within the two months of this report.
- Channels 4-6 remained almost stable between July and August 2010 showing a very small throughput loss of less than 0.1% per month.
- The decrease in throughput for channels 7 and 8 is also quite small (about 0.2-0.3% per month).
- The throughput of channel 8 is currently at about 70%.

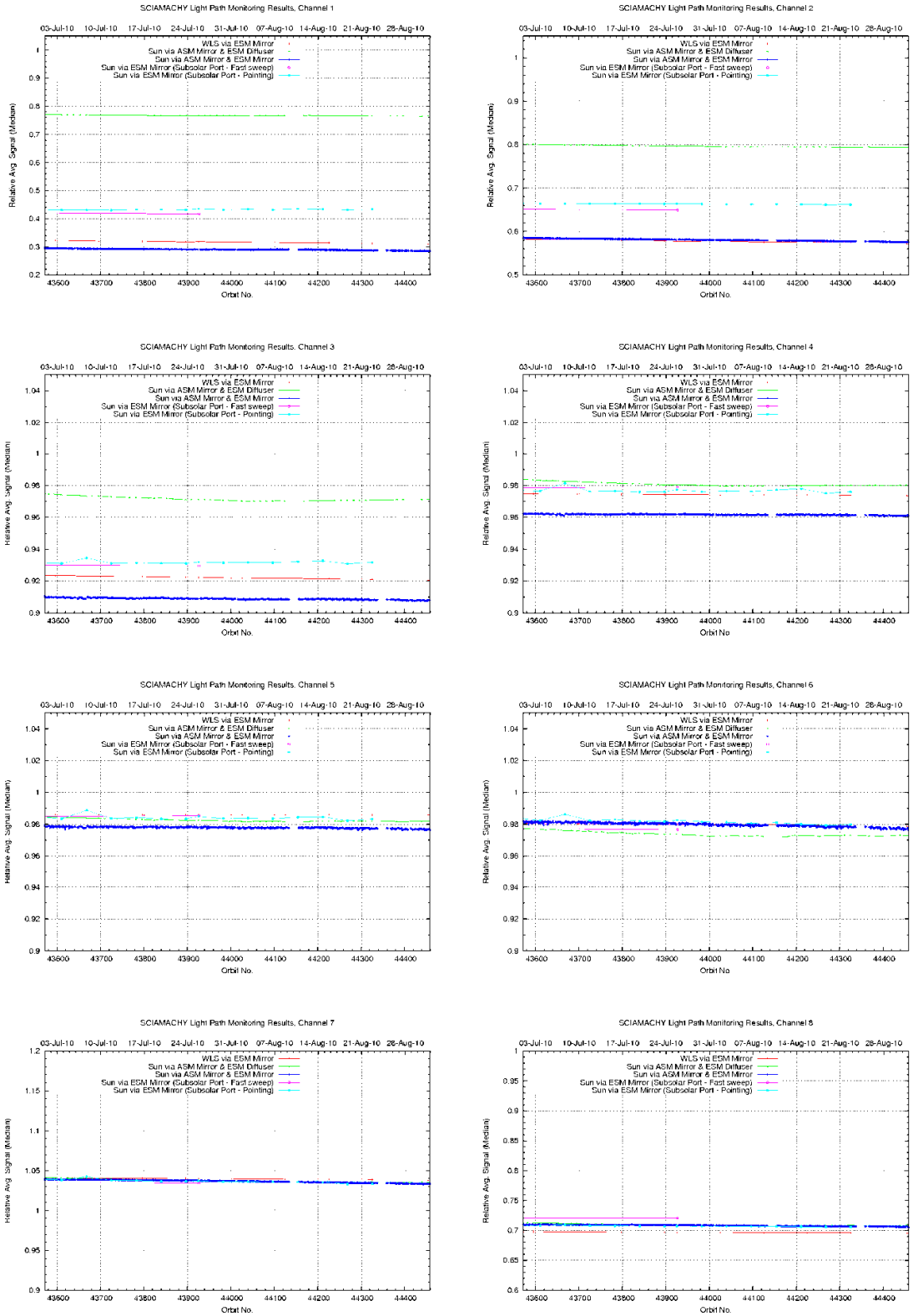


Fig. 3.7: Light path monitoring results July to August 2010 (medians).

3.1.5.2 Spectral light path monitoring results

Starting from the Bi-Monthly report January-February 2010, spectral light path monitoring results have been replaced by corresponding m-factor results (based on fully calibrated Level 1 data) shown in Section 4. Nevertheless, the Level 0 based spectral monitoring data are still available via the SOST-IFE web site (see http://www.iup.uni-bremen.de/sciamachy/LTM/LTM_spectral/LTM_spectral.html).

3.1.5.3 PMD monitoring results

The SCIAMACHY PMDs are monitored in a similar way as the science channels, but of course no channel averaging is performed. However, the results presented here are based on the same measurements as the science channel results (but using the PMD low gain signal), and they have been normalized to the same reference times as the spectral results. Figure 3.8 shows the PMD throughput variation for the whole time period between 2 August 2002 and end of August 2010. Note that a constant dark signal for each of the PMDs has been assumed. To verify this assumption, Fig. 3.8 also shows the variation of the PMD dark signal over time, which is usually quite low.

Considering the broadband character of the PMDs, the observed PMD throughput changes are (except for PMD 4 and 7) very similar to those of the science channels.

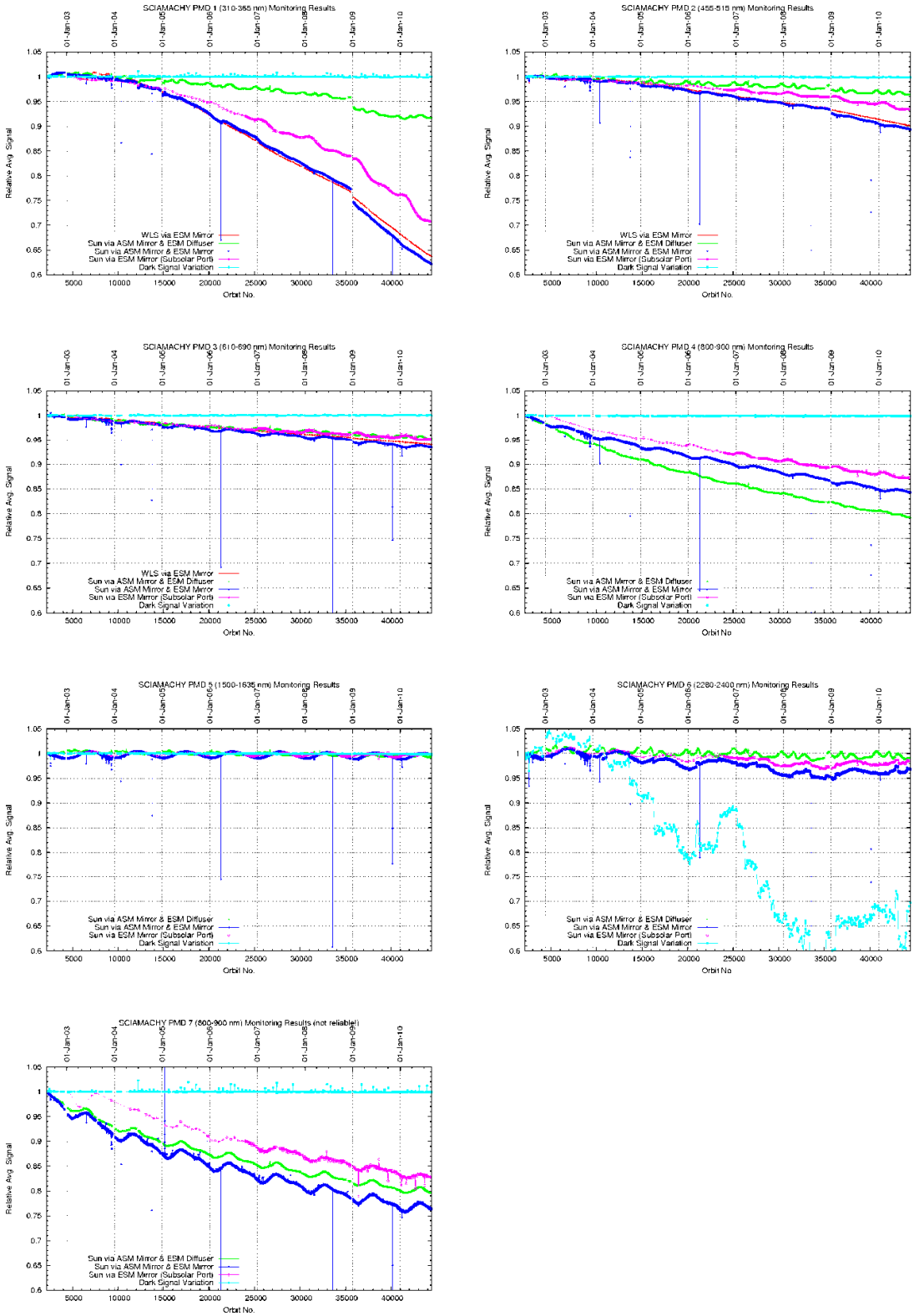


Fig. 3.8: PMD monitoring results August 2002 to August 2010.

4 DEGRADATION MONITORING AND CORRECTION

Since Level 2 product version 5.01, a correction for the radiometric degradation of SCIAMACHY is included in the operational processing. This degradation correction is performed by so-called m-factors. An m-factor is defined as the ratio between a measured spectrum of a constant light source (typically the sun) at a certain time to a spectrum obtained for the same optical path at a reference time. M-factors therefore provide an end-to-end degradation correction for each individual light path.
In general, m–factors have an impact on the polarization correction and on the absolute radiometric calibration. The m–factors for the science detectors are multiplicative factors to the absolute radiometric calibration of SCIAMACHY. The m–factors for the PMDs influence in a non-linear way the polarization correction of SCIAMACHY. Currently, only the science channel m-factors are used in operational data processing.
M-factors are regularly calculated by SOST-IFE and provided to ESA.

More details on m-factors and also the m-factors themselves can be found on the IUP Bremen web site under http://www.iup.uni-bremen.de/sciamachy/mfactors.

Figures 4.1 to 4.3 show plots of the science channel degradation (=1/m-factor) observed for each of the SCIAMACHY light paths (nadir, limb, calibration). The current plots cover the time range 2 August 2002 (reference time) to end of August 2010. For each science channel, the plots consist of three main areas: The central part is the contour plot of the degradation. On top of it is the median of the degradation over the detector pixels plotted, showing the overall behaviour of the channel. Right of the main area, the degradation of the last plotted day is shown. The grey bars in the plot are times of instrument unavailabilities (no data at all or the instrument was not in nominal state).
The current status of the degradation can be summarised as follows:

- The throughput is below 40% over almost the whole limb light path in channel 1 (i.e. below about 310 nm). In the nadir light path the throughput is lower than 40% below about 270 nm.
- The minimum throughput around 350 nm in channel 2 is currently about 50%.
- The minimum throughput in channel 3 is currently about 80% (not considering the overlaps).
- The throughput of channels 4 and 5 is stable over the whole spectral range (except for the overlaps).
- Channel 6 shows a small throughput decrease at the lower wavelength edge, which is an indication for ice growth.
- The throughput of channels 7 and 8 remains stable (except for dead/bad pixels). Increased noise in channel 7 (as noted in the previous report) is no longer observed at the end of August.

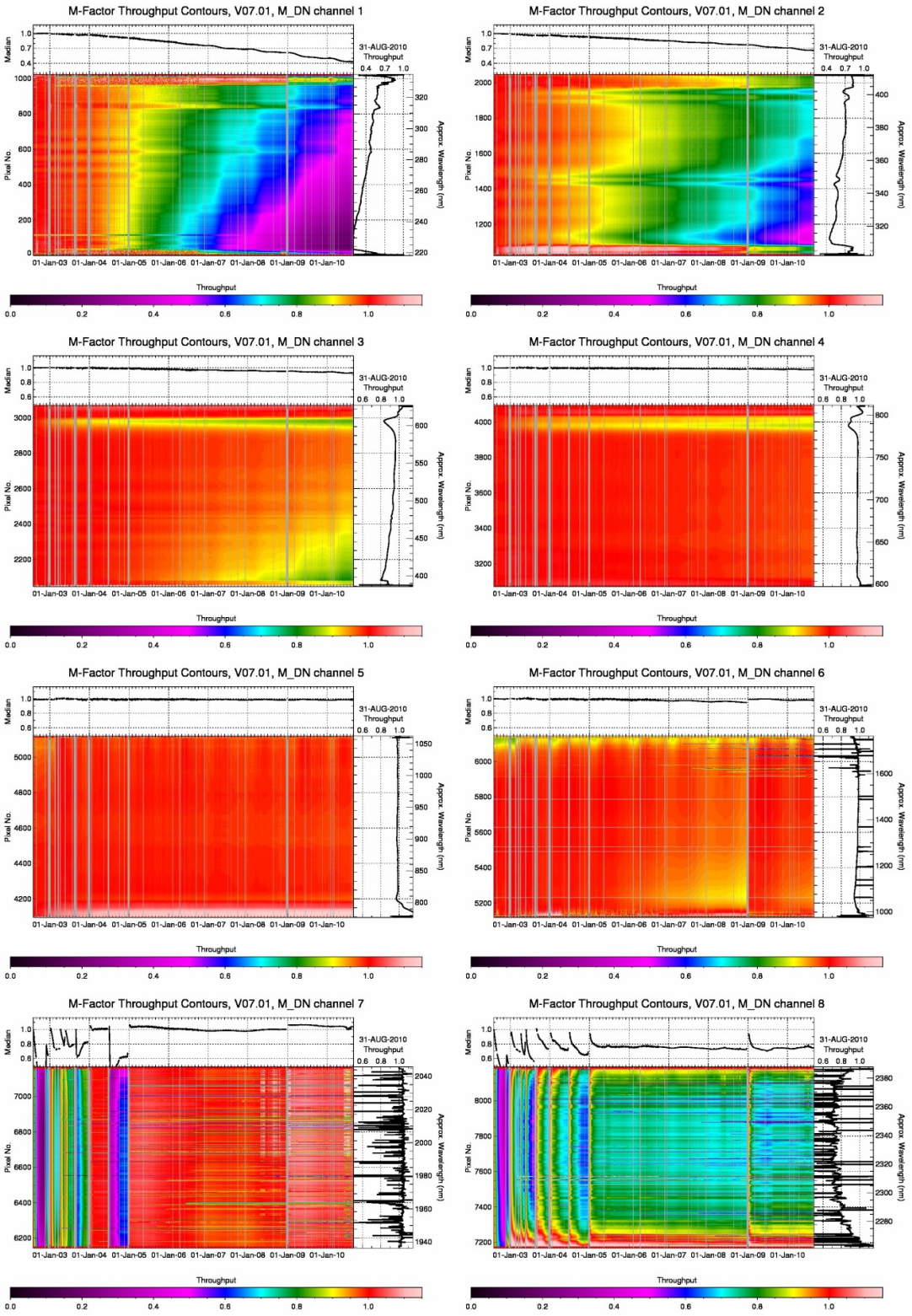


Fig. 4.1: Degradation derived from m-factors August 2002 to August 2010 (nadir light path).

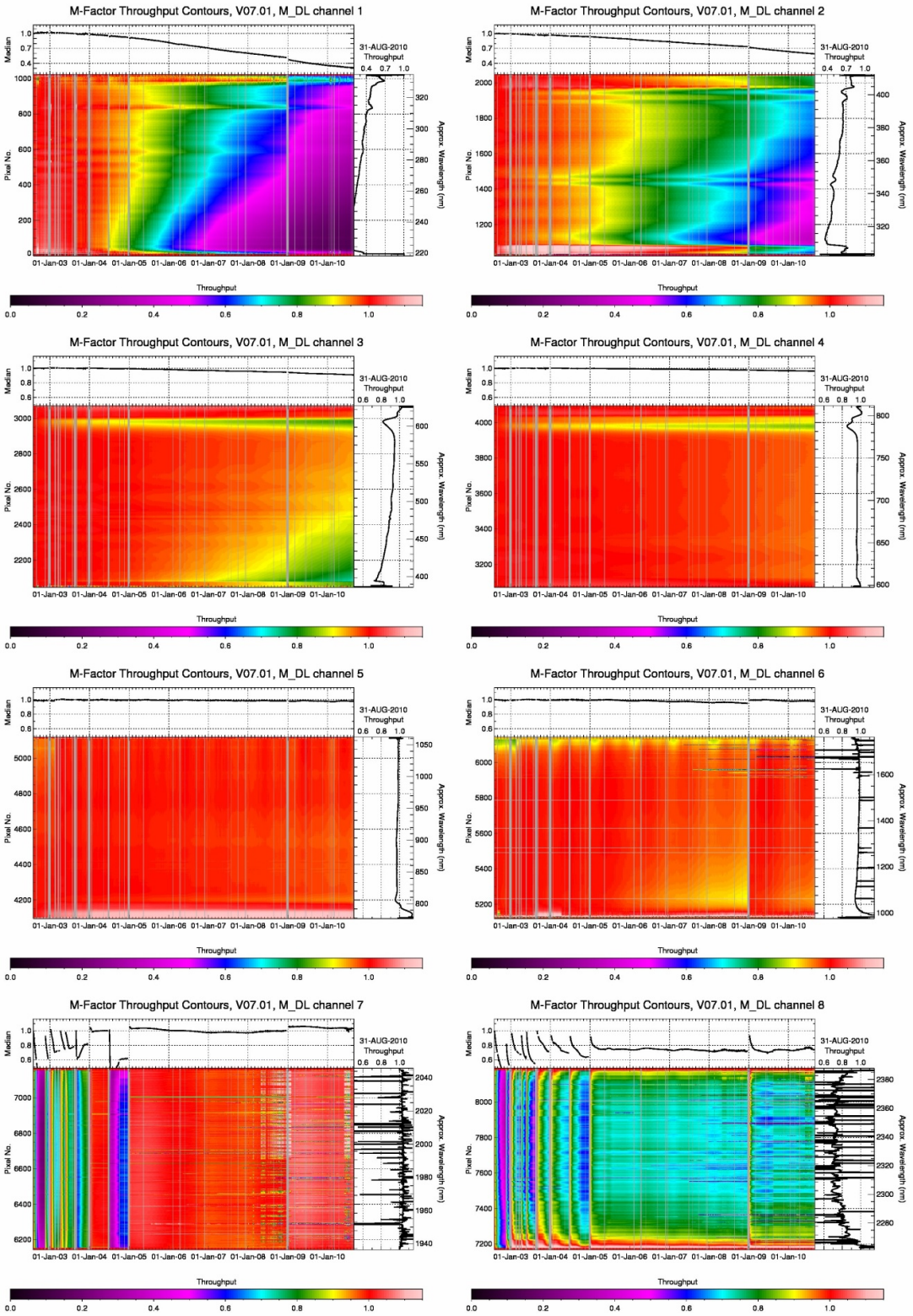


Fig. 4.2: Degradation derived from m-factors August 2002 to August 2010 (limb light path).

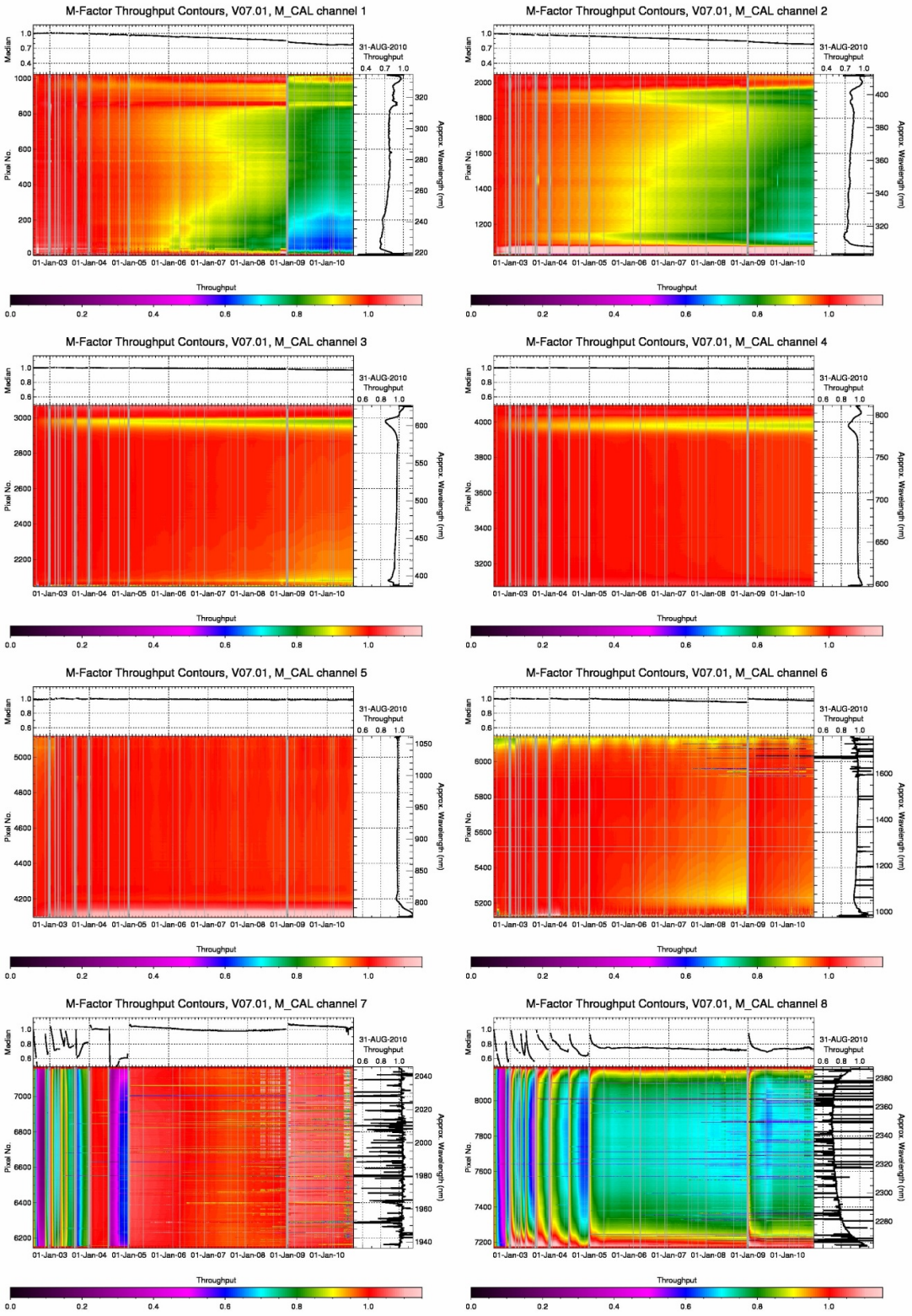


Fig. 4.3: Degradation derived from m-factors August 2002 to August 2010 (calibration light path).

5 DATA AVAILABILITY STATISTICS

5.1 Downlink/Acquisition Performance

For the reporting period, problems are known for the Level 0 products listed in Table 5.1.

Day	Filename	Description
03-Jul-2010	SCI_NL__0PNPDE20100703_010242_000051182090_00460_43600_1864.N1	Duplicate
19-Jul-2010	SCI_NL__0PNPDE20100719_005854_000051902091_00188_43829_1869.N1	Duplicate
01-Aug-2010	SCI_NL__0PNPDE20100801_005111_000051792091_00374_44015_2051.N1	Duplicate
07-Aug-2010	SCI_NL__0PNPDE20100807_010313_000051752091_00460_44101_2091.N1	Duplicate
20-Aug-2010	SCI_NL__0PNPDE20100820_005507_000041552092_00145_44287_2172.N1	Duplicate
23-Aug-2010	SCI_NL__0PNPDE20100823_010039_000056522092_00188_44330_2193.N1	Duplicate
26-Aug-2010	SCI_NL__0PNPDE20100826_010432_000027682092_00231_44373_2102.N1	Duplicate
29-Aug-2010	SCI_NL__0PNPDE20100829_011042_000053712092_00274_44416_2230.N1	Duplicate

Table 5-1 Level 0 products containing format errors or duplicated.

5.2 Statistics on unconsolidated data (SCI_NL__0P, SCI_NL__1P)

This paragraph reports the availability of NRT data on a monthly basis. The statistics are based on Level 0 and Level 1 data inventoried in the ground segment. Unavailability periods due to instrument anomalies or satellite switch-offs are excluded. The gaps considered are only interfile gaps. Statistics of Level 1 NRT data production are calculated with respect to Level 0 product availability.

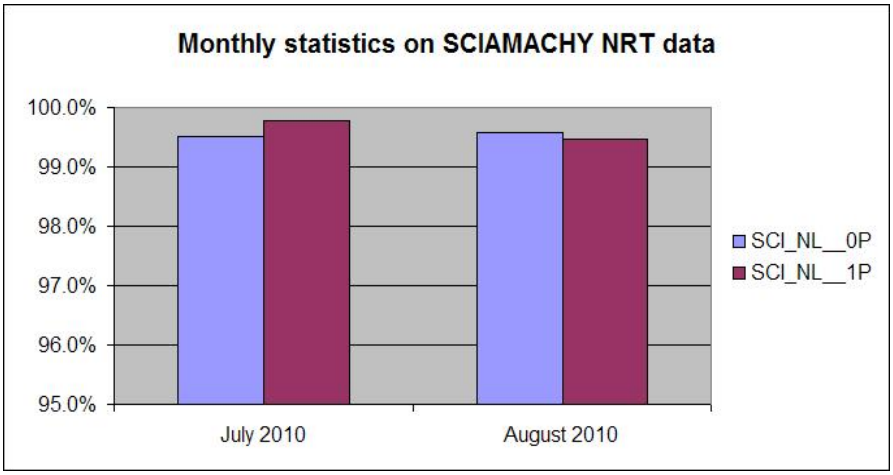


Figure 5-1: Statistics on available unconsolidated Level 0 and Level 1b products.

5.3 Statistics on consolidated data

In this Chapter an overview about operational off-line data (consolidated data) is provided.

5.3.1 Anomalies on Level 0 consolidated data products

In the past it had been reported by SOST-DLR that the SCIAMACHY consolidated Level 0 data contain errors and are not complete. Following specific problems have been identified and are reported in detail in the technical notes *[3]*, *[4]* for years 2003 and 2004 as well as for products of 2005 *[5]*:

- For one orbit there can be more than one consolidated Level 0 product. These products may be identical or different in content (disregarding the product type file counter).
- Some orbits are not covered by consolidated Level 0 products although SCIAMACHY was operational.
- Some orbits are covered by consolidated Level 0 products but the product duration does not comply with the actually planned and executed instrument operations in that particular orbit.
- Some consolidated Level 0 products exceed the Reed Solomon correction threshold and are flagged accordingly. The occurrence of Reed Solomon errors is non-uniform.
- Until late October/early November 2003 consolidated Level 0 data are hampered by an incorrect orbit number.

More details on consolidated Level 0 anomalies can be found on the SOST web page, which contains a catalogue of available Level 0 consolidated data and description of errors (http://atmos.caf.dlr.de/projects/scops/data_availability/availability.html).

The consolidation activity, reprocessing erroneous Level 0 data, has been completed up to year 2008. For year 2009 the recovery will be soon performed. The overall goal is to achieve a Level 0 consolidated data 'master set' that allows data reprocessing of improved data quality.

5.3.2 Availability of consolidated SCI_NL__1P products

SCIAMACHY Level 1b consolidated data are generated at D-PAC using the consolidated Level 0 products as input for processing. The available Level 1b off-line products on the D-PAC ftp-server are checked for completeness and an overview for the months of July and August 2010 is summarised here, considering flight segment and ground segment anomalies. Note that also interfile gaps are considered, but no data gaps inside the products.

The FTP address accessing the data server at D-PAC is ftp-ops-dp.eo.esa.int.

Please, note that with the activation of the new SCIAMACHY Level 1b processor version 7.03, the account to access the off-line consolidated Level 1b product at D-PAC was modified. The SCIAMACHY historic Level 1b data set from August 2002 to January 2010, processed with the previous processor Version 6 and processing flag "R" (SCI_NL__1PR) has been temporarily migrated to a different user account at DLR (scia1old). Operational SCIAMACHY Level 1b data products (version 7.03 and 7.04), with processing flag "U" (SCI_NL__1PU) starting on the sensing orbit 41287 (acquisition day 22/01/2010) are nominally accessible as before (scia1usr account) from the D-PAC FTP server (ftp-ops-dp.eo.esa.int). The scia1usr account also hosts reprocessed Level 1b products generated with IPF version 7.03 from 02 August 2002.

Access details for both accounts can be obtained from the Earth Observation Helpdesk.

A new configuration for the data access at D-PAC with a unique account will be set up in the coming months, and users will be informed accordingly.

Month/Year	Planned orbit range	Number of orbits unavailable due to anomalies	Number of unique orbits available at D-PAC	Expected number of orbits (considering anomalies)	Availability in percentage during month
July 2010	43572-44015	4	439	440	95.95%
August 2010	44016-44459	22	396	422	92.73%

Table 5-2: Statistics on consolidated Level 1b products.

5.4 Statistics on reprocessed data

5.4.1 Level 1b re-processing

The full-mission reprocessing of the SCIAMACHY Level 1 data set with processor version 7.03 covering the time range from August 2002 to the activation of the off-line forward processing (22 January 2010 - orbit 41287) has been completed.

The re-processed IPF 7.03 Level 1b data set with processing flag U is available on the operational D-PAC FTP server (ftp-ops-dp.eo.esa.int).

A recent investigation pointed out the existence of gaps in the SCIAMACHY Level 1b reprocessed data set, in particular between 22/10/2003 and 29/02/2004. About 1700 SCIAMACHY Level 0 products for years 2003 and 2004 have been found not reprocessed with IPF 7.03 and the corresponding Level 1b products missing on the D-PAC archive. Level 0 to 1b reprocessing with IPF version 7.04 of the missing orbits was performed.

The previous data set of Level 1b version 6 products with processing flag R will remain available to the users on a different account at D-PAC (eoa-dp.eo.esa.int) for a period of about four months. Afterwards the data will not be on-line anymore.

Science users are recommended to use the data set processed with the newest processor version 7.

Access details can be obtained contacting the Earth Observation Helpdesk.

5.4.2 Level 2 re-processing

The full-mission reprocessing of SCIAMACHY consolidated Level 2 data with the new processor version 5.01 was commenced at D-PAC end July 2010. Level 2 version 5.01 data have been processed sequentially and made available progressively on the usual FTP account at DLR (sciaol2usr on the ftp-ops-dp.eo.esa.int server). The reprocessing activity involves SCIAMACHY data products for the time range from 02 August 2002 (orbit 2203) to 22 January 2010 (orbit 41287). At the beginning of September 2010, the SCIAMACHY Level 2 reprocessing was discontinued on the basis of results from the preliminary validation activities. While most of the new and updated geophysical parameters show very good to acceptable quality, Carbon Monoxide (CO) did fail the validation: the CO column densities contained in SCIAMACHY Level 2 version 5.01 products are of unreliable quality. Users shall not use the CO information in its current implementation. Solutions for the improvement of the CO product are currently being investigated. Currently the Level 2 reprocessed

data set (SCI_OL__2PU) is available for the time range from 02 August 2002 to August 2004.

Operational SCIAMACHY Level 2 data products (version 5.01) from the off-line forward processing are nominally accessible as before (sciaol2usr account) starting from sensing orbit 41287.

Please, note that in preparation of the re-processing activity, all the Level 2 files with processing stage flag R (SCI_OL__2PR from August 2002 to January 2010) generated with the previous processor version 3.01 were migrated to the account sciaol2old of the D-PAC FTP server (ftp-ops-dp.eo.esa.int). This data set will remain available to the users up to completion of the full-mission reprocessing.

Access details of the new account can be obtained contacting the Earth Observation Helpdesk.

6 LEVEL 1 PRODUCT QUALITY MONITORING

6.1 Processor Configuration

6.1.1 Version

The IPF currently in use at Kiruna and ESRIN PDHS for the operational processing of near-real-time SCIAMACHY Level 1b data is version 7.04 since 15 June 2010. The same IPF is adopted for the forward processing of Level 1b off-line data at D-PAC and was activated since acquisition data from 17 June 2010, orbit 43375.

IPF 7.04 was developed in the frame of the ENVISAT 2010+ mission extension project which implements the lowering of the satellite's orbit to extend the mission until end 2013. SCIAMACHY orbit change maneuvers are planned at end of October 2010. Details can be found on the ESA news available at

http://earth.esa.int/object/index.cfm?fobjectid=6999
http://earth.esa.int/object/index.cfm?fobjectid=7024
http://earth.esa.int/object/index.cfm?fobjectid=7223

IPF 7.04 does not include evolution aspects in the algorithm compared to prior IPF 7.03, but just updates the CFI library to version 5.8.1 (http://eop-cfi.esa.int/CFI/Registration.html). No format change has been introduced in the new Level 1b product version 7.04.

Starting from the operational Level 1b data version 7.03, a new type of Limb state is available: Mesospheric Limb Measurements (state ID: 55) are performed scanning altitudes between 60 and 150 km. The measurements are performed instead of "normal" limb states for 30 orbits every month on two separate days. The operational Level 2 processor does not process the scientific Mesospheric Limb Measurements.

The radiometric degradation of SCIAMACHY can be compensated using m-factors, calculated from the new NRT Level 1b data. M-factors are not part of the Level 1b product and are not used at present in the Level 0-1b processing itself. They are applied in the Level 2 data processing. The m–factors are provided by an external database accessible at http://www.iup.uni-bremen.de/sciamachy/mfactors/.

The corresponding Product Specification is Volume 15 issue 3L version 1.1 *[2]*.
This document is available at
http://earth.eo.esa.int/pub/ESA_DOC/ENVISAT/Vol15_Sciamachy_3L_1.1.pdf

The Product Quality Disclaimer at
http://envisat.esa.int/dataproducts/availability/disclaimers/SCI_NL__1P_Disclaimers.pdf
was updated corresponding to the IPF version 7.03 and describes known artefacts as well as major improvements with respect to the previous IPF version 6.05.

Table 6.1 gives a brief overview of changes implemented in the SCIAMACHY Level 0 to Level 1b processing baseline compared to prior processor versions.

IPF Version	Description	Proc Centre	Date	Start Orbit
7.04	In view of the ENVISAT 2010+ mission extension requiring the lowering of the satellite's orbit, the new IPF 7.04 was developed without introducing changes in the algorithm but updating the CFI library to version 5.8.1.	D-PAC	17-JUN-2010	43375
		PDHS-E	15-JUN-2010	43355
		PDHS-K	15-JUN-2010	43347
7.03	Following changes are implemented with IPF 7.03: • Degradation correction using m-factors implemented in SciaL1c. • Improved spectral stray light correction using a matrix approach in channel 2. • Mesospheric Limb Measurements included in the Limb MDS. • Correction of the Scanner encoding values.	D-PAC	22-JAN-2010	41287
		PDHS-E	04-FEB-2010	41479
		PDHS-K	04-FEB-2010	41472
6.05	No evolution in the algorithm has been introduced with IPF 6.05 but the processor was ported from AIX to LINUX.	D-PAC	05-OCT-2009	39634
		PDHS-E	29-SEP-2009	39633
		PDHS-K	29-SEP-2009	39639
6.03	The following changes are implemented with IPF 6.03 • New pointing correction (new SCI_LI1_AX) • Updated of the ESA CFI (5.6) software • Correction of a non compliancy report, impacting the Leakage GADS in the consolidated data processing chain (channels 6-8)	D-PAC	04-JUL-2007	27937
		PDHS-E	19-JUL-2007	28153
		PDHS-K	19-JUL-2007	28145

Table: 6-1: Processor version and main changes.

6.1.2 Anomalies

Two SCIAMACHY consolidated Level 1b products, generated during the SCIAMACHY full-mission reprocessing campaign with IPF 7.03, were found corrupted in the D-PAC FTP server (account scia1usr) with file size different from the value indicated in the MPH. As corrective action, the corrupted products were removed from the FTP server and reprocessed. The corrupted products are:

SCI_NL__1PUDPA20050806_045632_000060612039_00363_17952_1440.N1

SCI_NL__1PUDPA20050806_132002_000060032039_00368_17957_1445.N1

In addition, the product for orbit 34327 resulted corrupted for an incomplete upload to the FTP server. The complete product is now available.

SCI_NL__1PUDPA20080923_040203_000060322072_00205_34327_9090.N1

Details on anomalies affecting SCIAMACHY Level 1b products can be found at http://earth.eo.esa.int/pcs/envisat/sciamachy/reports/anomalies/.

6.2 Auxiliary Data Files

For operation of the SCIAMACHY Level 1 processor, a set of auxiliary files as input is required. One subset of these auxiliary files usually changes only in correspondence with a new IPF version, namely the Initialisation file (SCI_LI1_AX) and the Key Data file (SCI_KD1_AX).

Table 6-2 lists the actual Key Data File and Initialisation File used with IPF 7.03.

Table 6-2: Key Data and Initialisation configuration

SCI_KD1_AXNIEC20091126_123849_20020301_000000_20991231_235959
SCI_LI1_AXNIEC20091126_125714_20020701_000000_20991231_235959

Another subset of auxiliary files is the in-flight calibration data files, which are generated when calibration measurements are included in the set of Level 0 data to be processed.

Four types of in-flight calibration auxiliary files exist:

- Leakage Current Calibration (SCI_LK1_AX - updated on orbital basis)
- Solar Reference Spectrum (SCI_SU1_AX - updated on daily basis)
- Spectral Calibration Parameters (SCI_SP1_AX - updated on a weekly basis)

- Pixel-to-Pixel Gain and Etalon Parameters (SCI_PE1_AX - updated on orbital basis).

Figure 6.1 shows statistics of the SU1, LK1, PE1 and SP1 auxiliary data files (ADFs) generated operationally with SciCal 2.2 for July and August 2010. Statistics are based on the SciCal ADFs production/distribution to PDGS and are calculated with respect to the number of auxiliary files expected. It has to be noted that unavailability periods are excluded from statistics as well as duplicated products identified on the basis of the start/stop validity time in the filename.

LK1 statistics are calculated dividing the number of LK1 auxiliary files (generated on orbital basis) by the number of available (to SciCal) Level 0 products. These statistics do not exclude dark measurements that cannot be used for ADF generation due to SAA and orbit phase constraints leading to an over-estimation of missing files.
SU1, SP1 and PE1 statistics are calculated with respect to the number of ADFs expected for the reporting months.

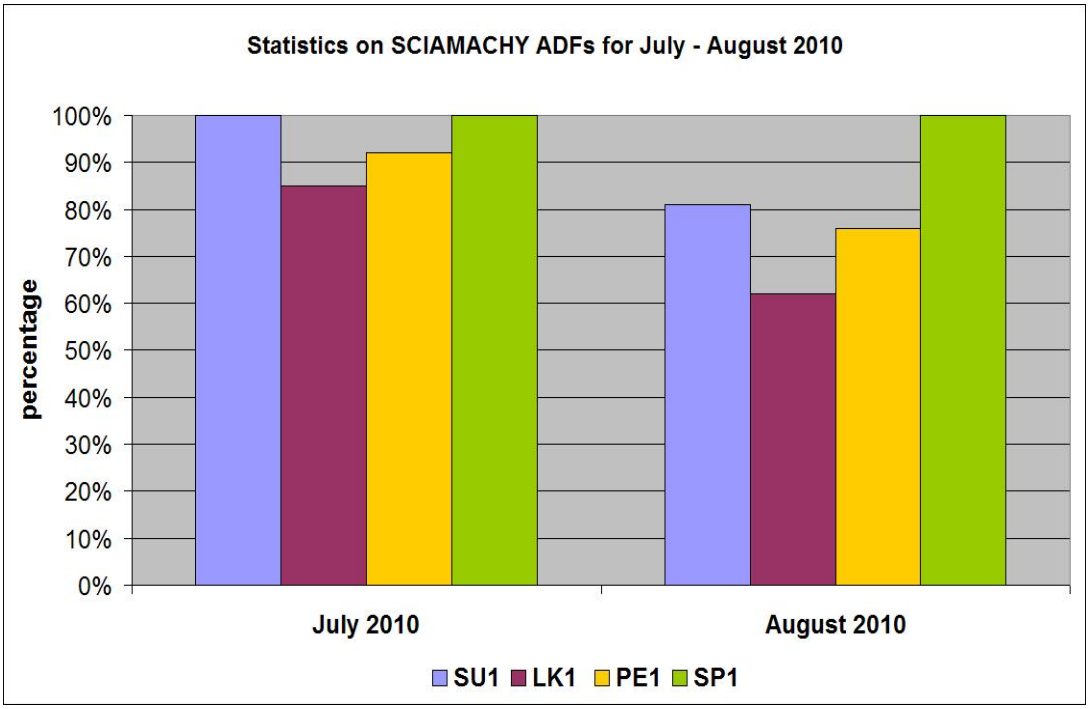


Figure 6-1: Statistics on SU1, LK1, PE1 and SP1 productions.

6.2.1 Auxiliary Data File quality analysis

6.2.1.1 SMR analysis

SciCal generates daily SU1 Auxiliary Files. Solar spectra obtained from ESM and ASM calibration measurements are provided in two ways:

- fully calibrated
- not radiometrically calibrated.

The different types of spectra can be recognized by the so called identifier in the solar reference global annotation data set record.
Note the following recommendation:

- Use a not radiometrically calibrated ASM diffuser spectrum (A0) for DOAS type applications.
- All retrieval methods requiring absolute calibrated radiance and irradiance are obliged to use the calibrated ESM diffuser spectrum (D0) (see also disclaimer).

Figures from 6-2 to 6-5 show the ratios of SMR spectra derived from calibrated SMR/ESM (D0) during the months July - August 2010. The ratios were determined by dividing the spectra of a set of days during each month to a spectrum at the beginning of each month. Ratios are not corrected for variation of distance Earth/Sun.
In detail the spectra used for the ratios of each month are the following:

- **July 2010**
  Reference SMR - 01 July 2010
  SMR used for ratios: 02, 03, 04, 05, 06, 07, 08, 09, 10, 14, 21, 31 July 2010.
- **August 2010**
  Reference SMR - 01 August 2010
  SMR used for ratios: 02, 03, 04, 05, 06, 07, 08, 09, 10, 14, 21, 31 August 2010.

The overall changes lie usually at about 1-2 % during one month for all channels, which is at least partially caused by the decreasing distance between Sun and Earth.
In channel 1, around pixel 550 (at 282 nm), some strong features can be noticed, as well as in channel 2 near pixel 840 (near 393 nm). These strong features coincide with the Mg II and Ca Fraunhofer lines respectively. These lines are partially formed in the solar Chromosphere and are known to change with solar variability.
The weaker spectral features in channel 2 (e.g. near pixels 550, 650,750), on the other hand, correlate with strong Fraunhofer lines, which are not chromospheric. These features probably arise from small wavelength shifts (order of 1/100 of a pixel).
Generally a spectral feature could have significant impact on the product quality, especially when the affected spectral parts are used for DOAS retrieval.

The large features in the end of channel 6 (channel 6+) and channels 7 and 8 are due to bad pixels. Note that the bad pixel mask used is still from the on-ground calibration.
A regular update of the bad pixel mask is implemented starting with IPF 6.02. However a bad pixel correction will not be applied to the SMR spectra, but only to PMD out-of-band factors, in order to enable the user to apply a different mask from the one provided by the ADF.

Figures 6-6 and 6-7 show SMR ratios as long term trends; plots are obtained dividing the ESM spectra from day 31 July 2010 and 31 August 2010, respectively with spectra from 31 July 2003 and 31 August 2003.
The first spectrum available exists for 18 July 2002. However to consider Sun/Earth distance, the ratio was performed with spectra from same calendar days.
All SCI_SU1_AX files used were generated with SciCal 2.2.

What can be concluded is that for channels 1-2 an average degradation in 6 years of about 10-15% is observed, channels 3 degrades by about 2% and channels 4-5 degrade by less than 1%, channel 6 by about 4-5%. The signal in channel 7 has increased with respect to the SMR of year 2003. This is due to the impact of the icing of the IR detectors. This is consistent with the Light Path monitoring at SOST-IFE and available at http://www.iup.uni-bremen.de/sciamachy/LTM/LTM_spectral/LTM_spectral.html.

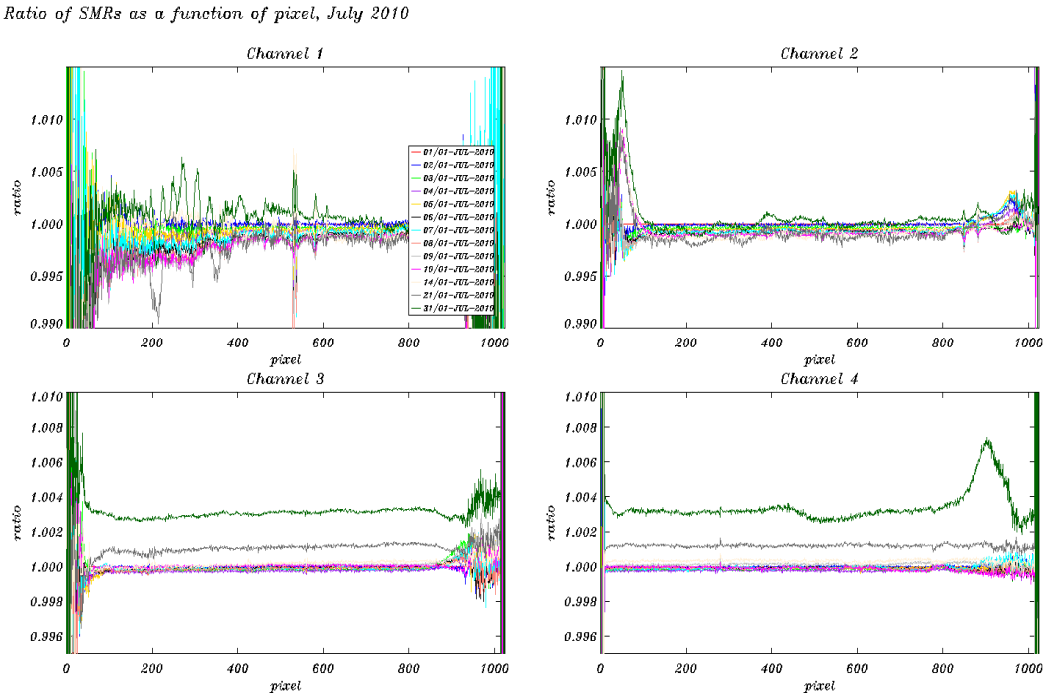


Figure 6-2: SMR ratios per detector channel 1-4 (changes during July 2010).

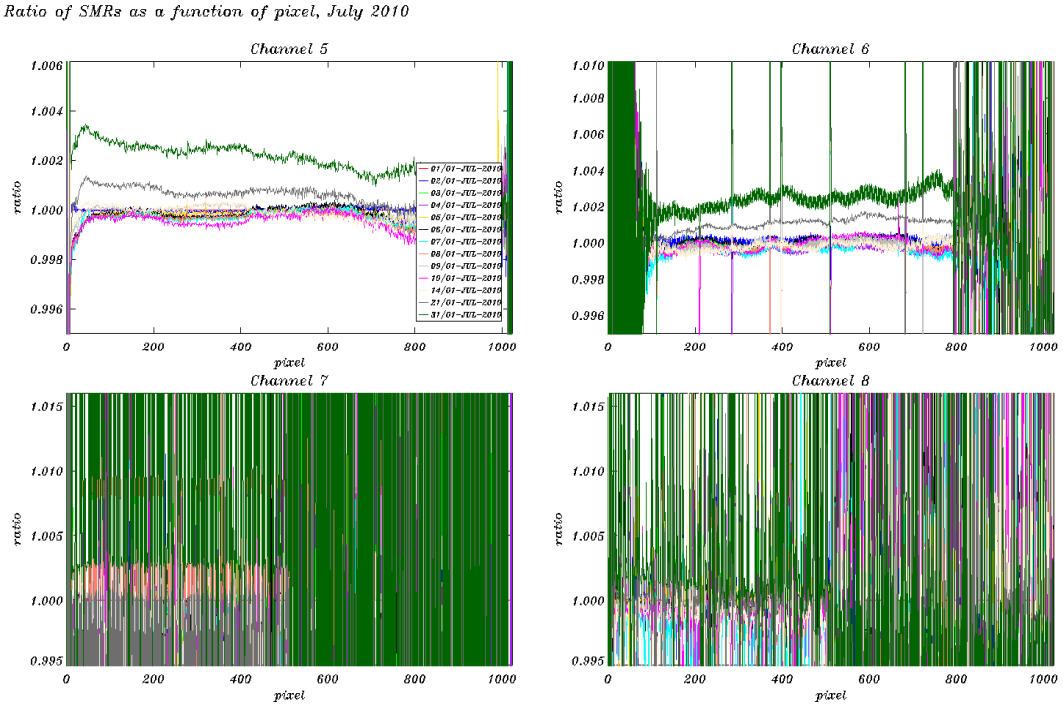


Figure 6-3: SMR ratios per detector channel 5-8 (changes during July 2010).

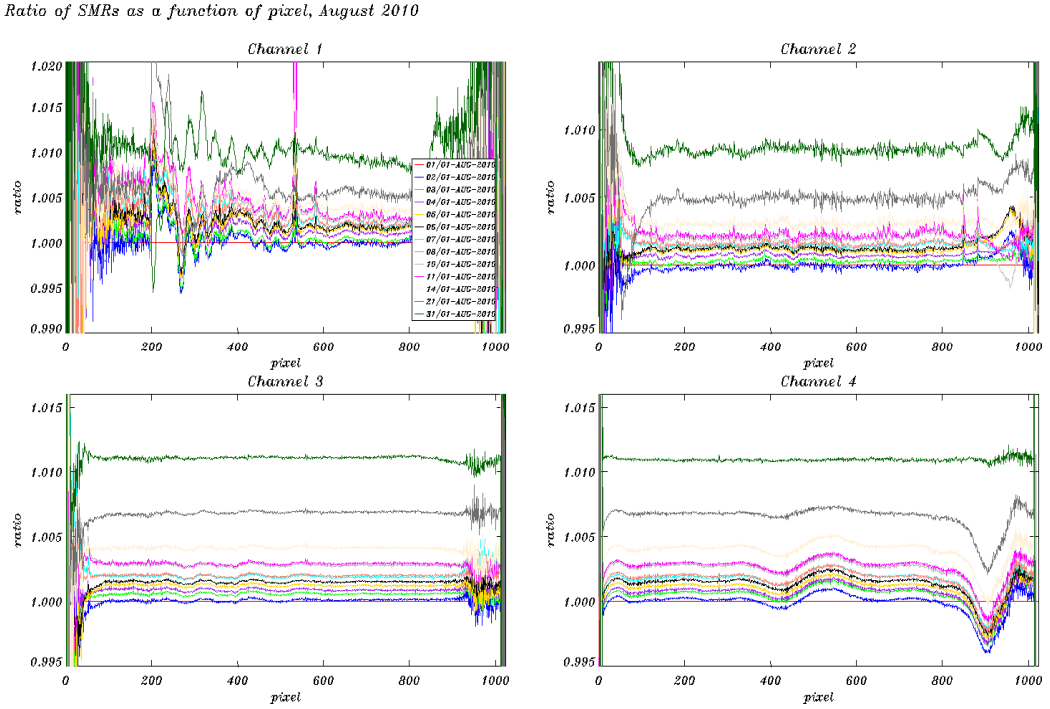


Figure 6-4: SMR ratios per detector channel 1-4 (changes during August 2010).

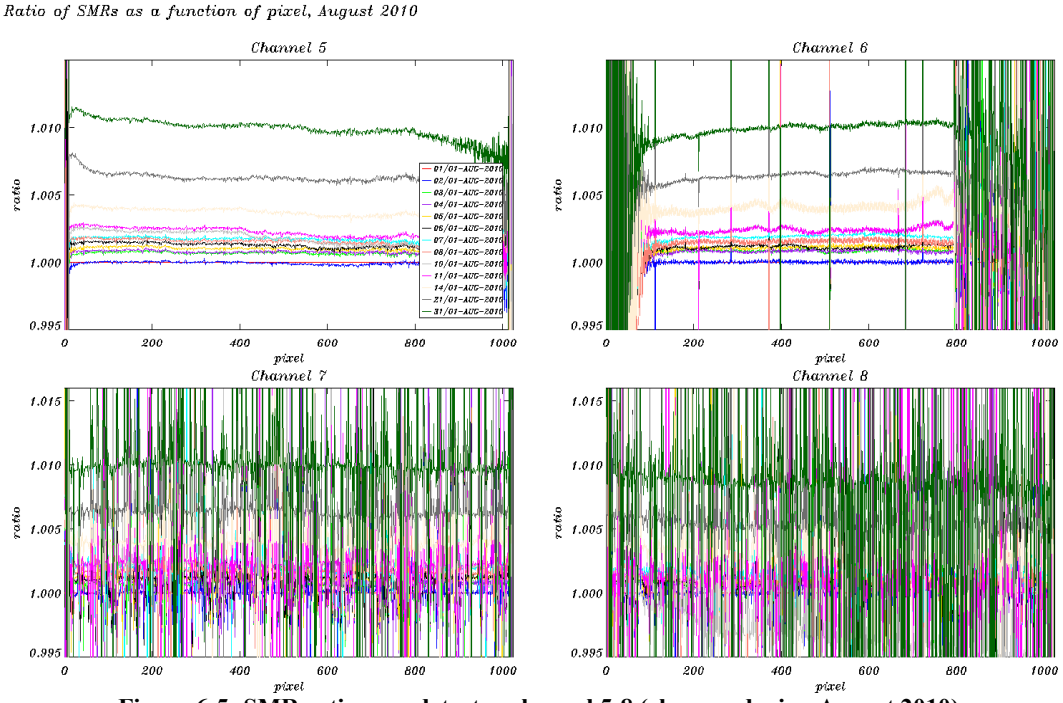


Figure 6-5: SMR ratios per detector channel 5-8 (changes during August 2010).

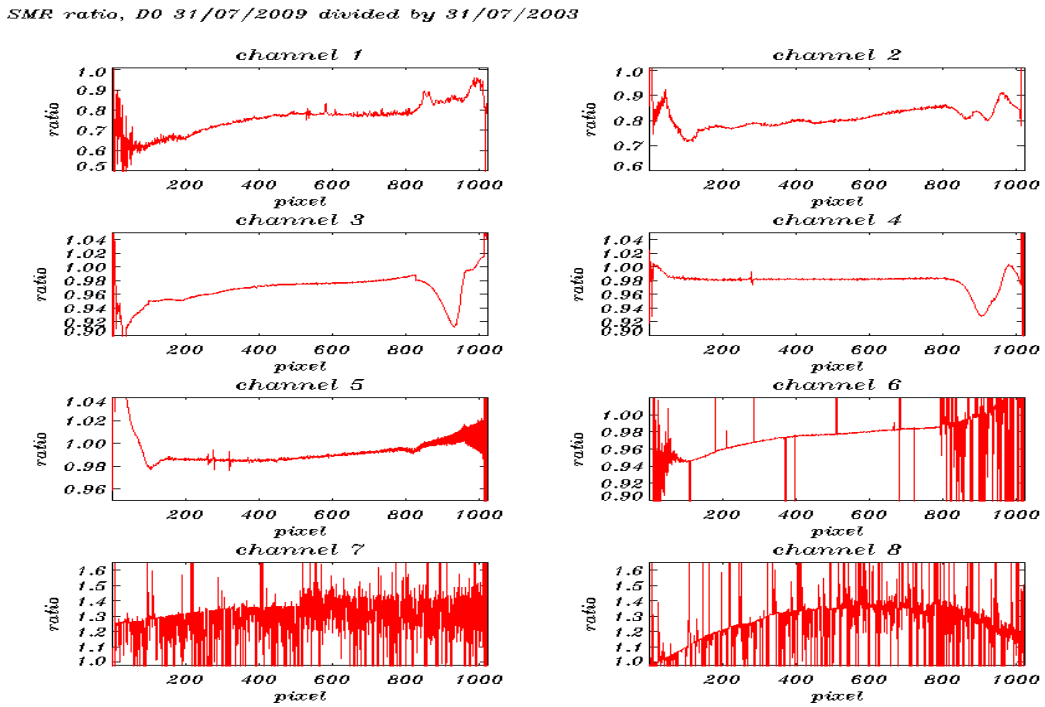


Figure 6-6: SMR ratios per detector channel on Long Term Trend 31/07/2010 divided by 31/07/2003.

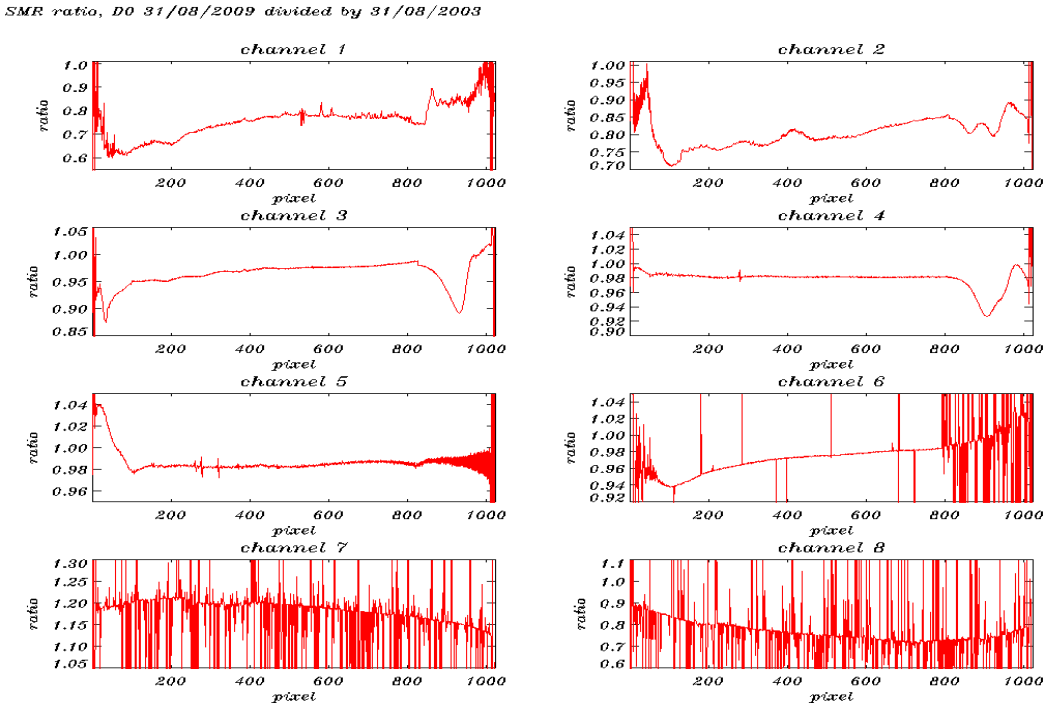


Figure 6-7: SMR ratios per detector channel on Long Term Trend 31/08/2010 divided by 31/08/2003.

6.2.1.2 LK1 analysis

6.2.1.2.1 Leakage Constant part

On an orbital basis a leakage current calibration is performed, if measurement data do not lie in the South Atlantic Anomaly region.
In Figures from 6-8 to 6-11 the leakage constant part FPN (fixed pattern noise) of the LK1 ADFs is analysed by determining the ratios of the FPN of each month with a time distance of one orbit, one day, one week, two weeks, three weeks and a month.
For channels 1-5 and the first part of channel 6, during up to three weeks nearly no changes can be noticed. Sudden jumps however between the different dark current ratios can be seen for channels 1, 2, 4 and 5 between 4 weeks. They are very small but above the noise level.
The IR channels show a lot of noise. Note that since the processor version IPF 6.03, the time dependent part of the leakage current is considered as well (see 6.2.1.2.2).

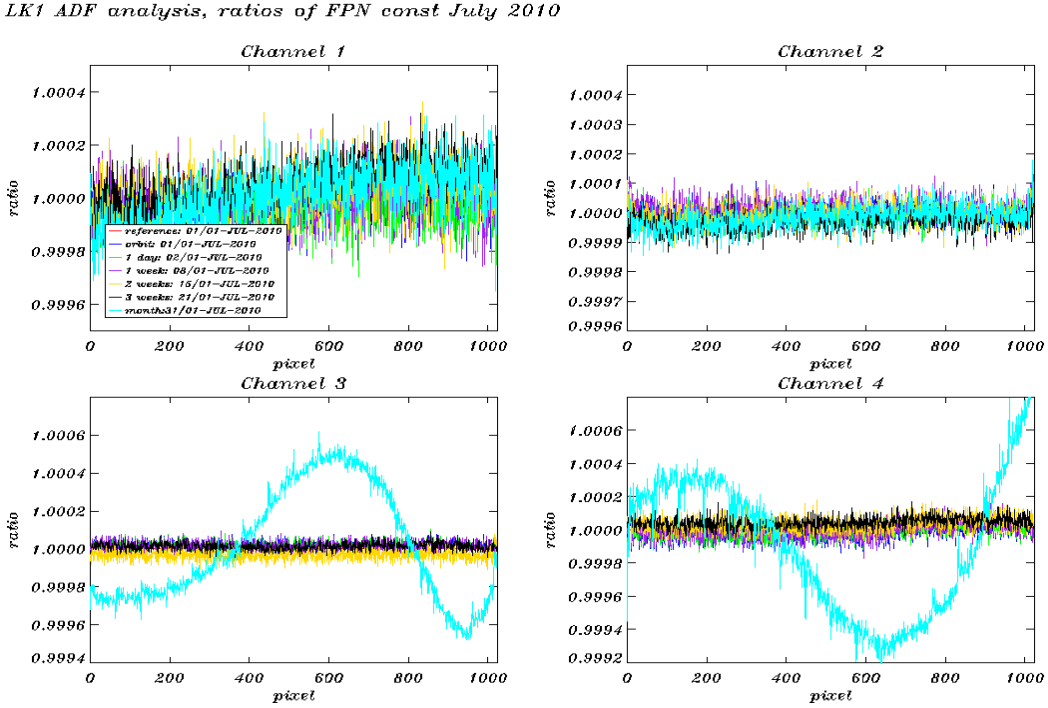


Figure 6-8: Dark current ratios (constant part) channels 1-4 during July 2010. Reference spectrum used: Orbit 43576, 01 July 2010.

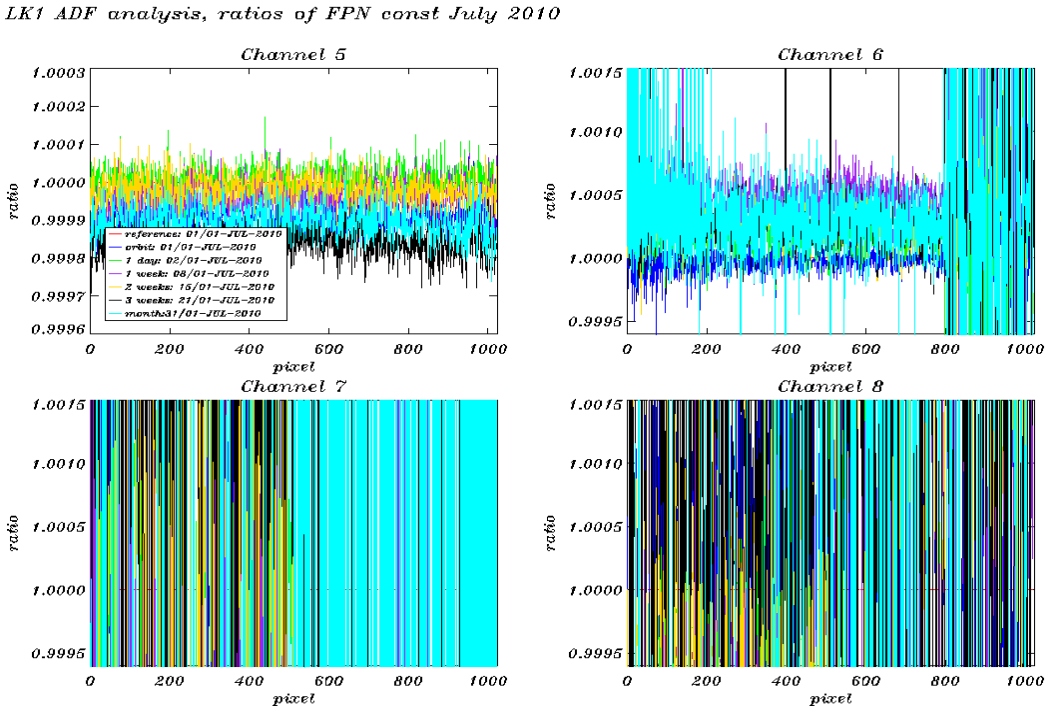


Figure 6-9: Dark current ratios (constant part) channels 5-8 during July 2010. Reference spectrum used: Orbit 43576, 01 July 2010.

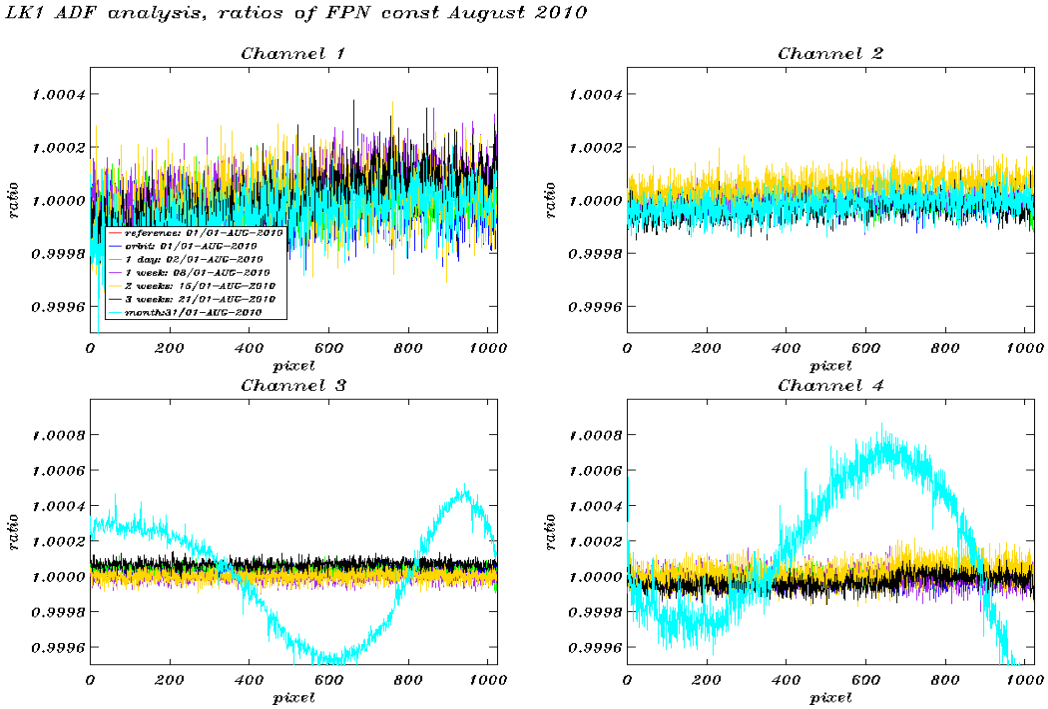


Figure 6-10: Dark current ratios (constant part) channels 1-4 during August 2010. Reference spectrum used: Orbit 44020, 01 August 2010.

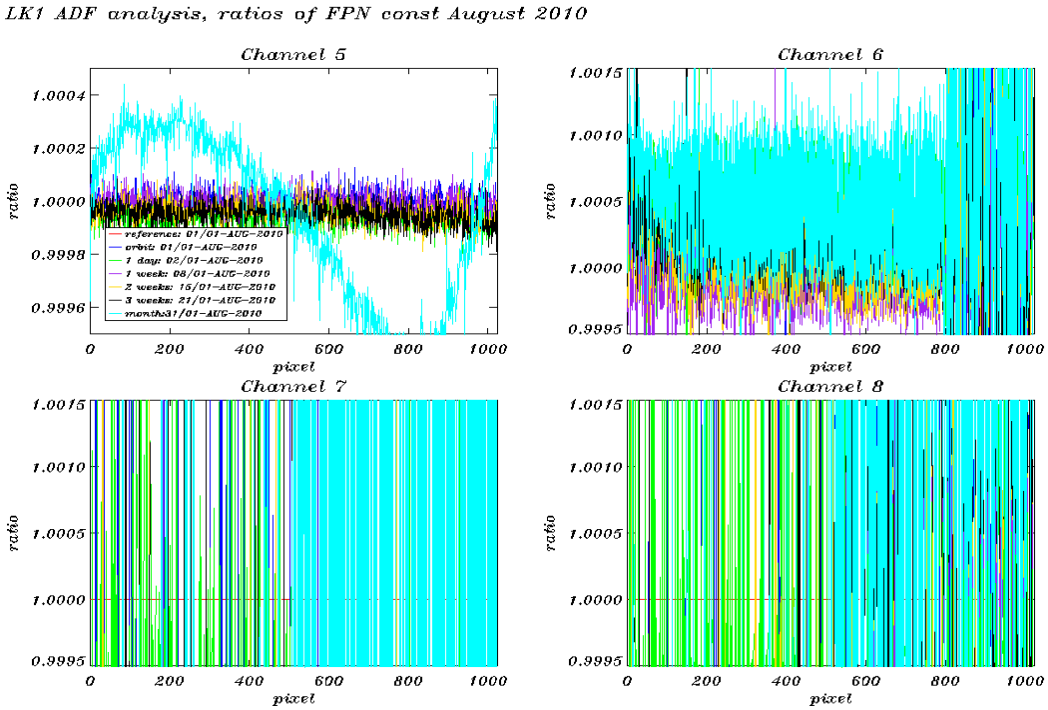


Figure 6-11: Dark current ratios (constant part) channels 5-8 during August 2010. Reference spectrum used: Orbit 44020, 01 August 2010.

6.2.1.2.2 *Leakage Variable part*

Starting with IPF 6.03, the orbital dependency of channel 6 to 8 leakage current is considered. SCIAMACHY detector channels 6 - 8 have a time dependent leakage dark signal that consists of two components, the leakage current of the detector pixel and second a component due to thermal background that varies along the orbit. The implementation of the orbital variation of the leakage current is expected to improve retrieval especially in detector channel 8 for infrared products.

Figure 6-12 shows the evolution of the leakage variable part of the SCI_LK1_AX ADF during the time span from 01 July 2010 to 31 August 2010. The leakage variation for a selected pixel in channel 7 corresponding to orbit phase 6 is shown. In the previous BMRs, the leakage variation for pixel 222 was reported; since June 2010 this pixel turned out to have an instable (possibly bad) behaviour therefore for the current reporting period the leakage current variation is shown for pixel 221.

Updates of the leakage variable are expected after the processing of the monthly calibration orbits, i.e. once per month. During the reporting period monthly calibration sequences were scheduled between orbits:

- 43926-43930 (25/26-Jul-2010)
- 44355-44359 (24/25-Aug-2010)

For these dates the change of the Leakage Variable value can be clearly seen, demonstrating that the calibration was performed successfully.

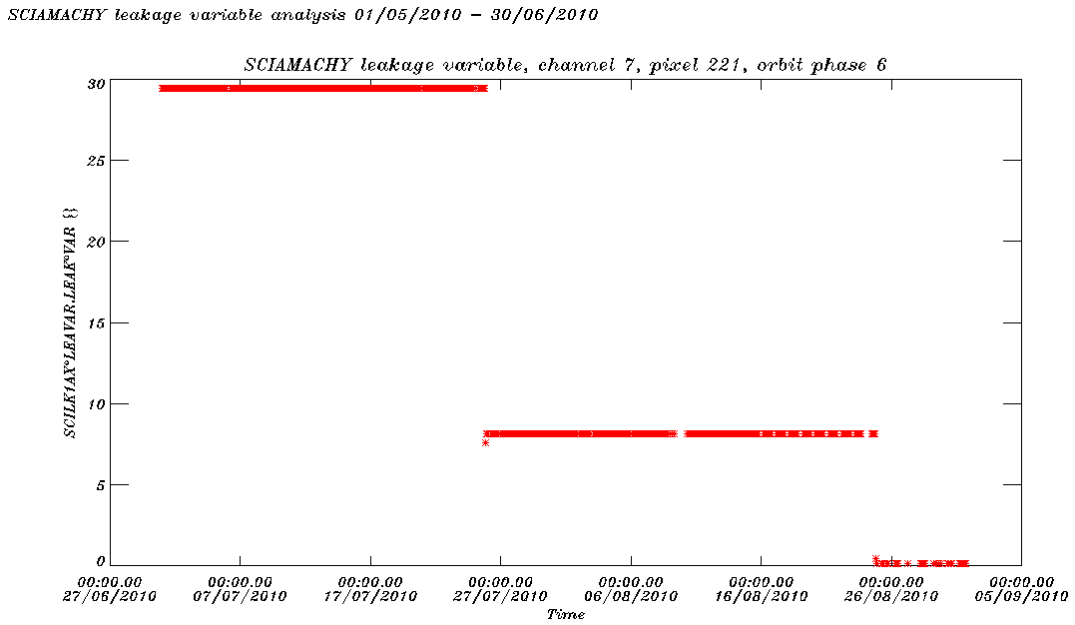


Figure 6-12: Leakage variable part from 01 July 2010 to 31 August 2010, for channel 7, orbit phase 6, pixel 221.

6.3 Bad and Dead Pixel Mask

6.3.1 Operational Processor Analysis

Starting from the Level 1b IPF 7.03 baseline, SCIAMACHY bad and dead detector pixel masks are generated on an orbital basis. The PPG/Etalon correction parameters required for the SCIAMACHY Level 0 to 1b processing are calculated by SciCal and enclosed in the SCI_PE1_AX auxiliary data files. The set of parameters generated is then written into the Level 1b PPG GADS indicating the position of pixels which may not be used for further processing. In the next BMR, results for the operational Bad and Dead Pixel Mask will be presented. The mask currently provided in the Level 1b products is not identical to the mask generated at SRON. It is planned to align the two masks in future processor versions.

6.3.2 SRON Analysis

SRON performs routinely analysis on the SCIAMACHY Bad and Dead Pixel Mask identifying bad pixels of the detector arrays with the SCIAMACHY Detector Monitoring Facility (SDMF) using 11 flagging criteria. These criteria are based on the dark signal model, transmission, gain and noise of a pixel. Bad pixel masks are calculated on an orbital basis and combined into a "smoothmask" with masks from about 50 orbits. In Fig. 5-13 we show the number/fraction of pixels that is flagged as bad for channels 6, 6+, 7 and 8. Note that channel 6 consists of two parts employing different detector materials. Channel 6+ starts at pixel 794. The rate at which the number of pixels that is flagged is increasing is similar for the IR channels 6+, 7 and 8. The fraction of flagged pixels in channel 6 is much lower and almost constant over the mission, because of the different detector materials used in this part of the channel.

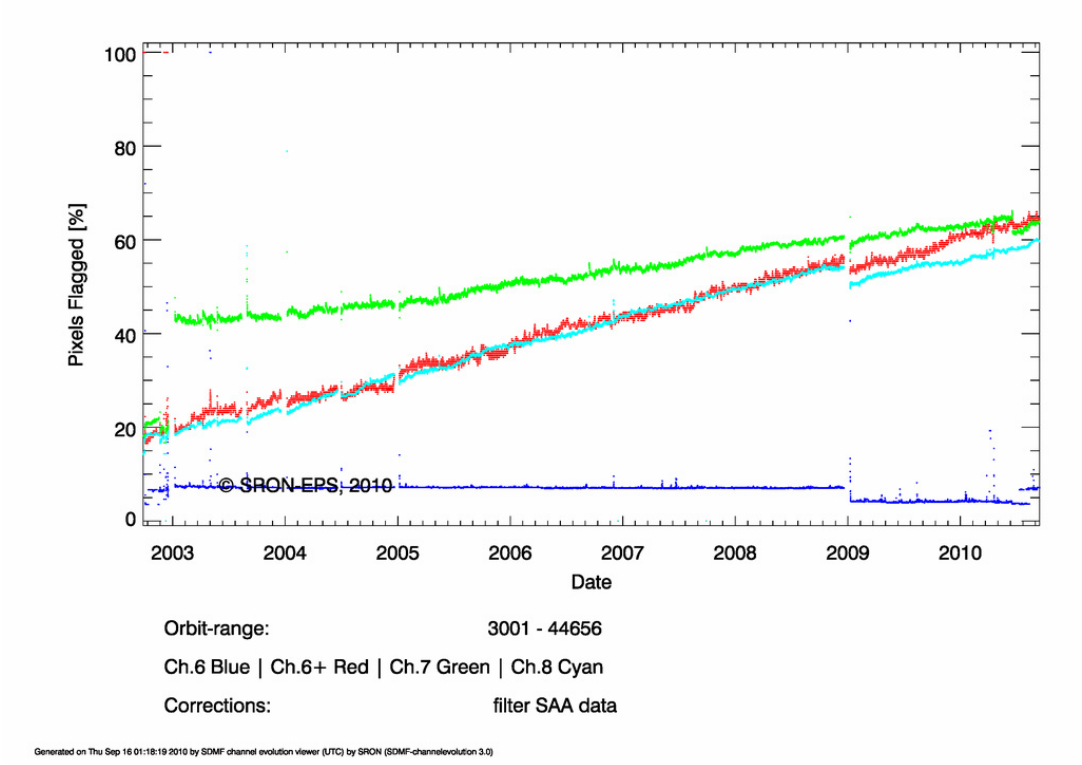


Figure 6-13: Number/Fraction of pixels that is flagged as bad by the SDMF smoothmask for channels 6 (blue), 6+ (red), 7 (green) and 8 (cyan). Orbits during SODAP or decontaminations have been removed. Note the temporary decrease in the number of bad pixels after the last decontamination, for channel 8 about 6%, a few percent more than after the previous decontaminations.

6.4 Pointing Performance

No updates to present in the reporting period.

6.5 SciaL1c tool

The SciaL1c tool is an application provided to the users of SCIAMACHY Level 1b products. This application allows selecting specific calibrations to apply to Level 1b data, which are in case of SCIAMACHY defined as not fully calibrated Level 0 channel information in combination with calculated calibration data. The generated Level 1c products are suitable for the user's particular applications.

The SciaL1c Calibration and Extraction Software was upgraded to be compatible with IPF 6.03 data. It is downward compatible, i.e. it can also be used with data from older IPF versions. SciaL1c can be downloaded at: http://envisat.esa.int/scial1c/

LINUX, Sun Solaris, LINUX on DEC-Alpha and HP-UX on IA64 versions are available.

The latest updated version 2.1 of the SciaL1c tool was provided to the users end of November 2008.

Please, note that an anomaly in the handling of the m-factor file during the calibration of SCIAMACHY Level 1b data was observed. The m-factor file (SCI_MF1_AX) is not correctly reported into the child product restituted from the SciaL1c processing. In particular, the MF1 ADF filename does not fully appear in the DSD descriptor. The quality of the product is not impacted; the anomaly will be fixed in the next delivery of SciaL1c.

7 LEVEL 2 NRT PRODUCT QUALITY MONITORING

7.1 Processor Configuration

7.1.1 Version

Since 08 May 2006 the near-real-time processing of SCIAMACHY Level 2 data has been suspended, evolution is restricted to the Level 2 off-line processor (see Section 8).
The last IPF version used was 5.04. The corresponding product specification is *[2]*.
The Product Quality Disclaimer at
http://envisat.esa.int/dataproducts/availability/disclaimers/SCI_NL__2P_Disclaimers.pdf
describes known artefacts.

An overview on the implementation dates of the IPF at the different PDS processing centres and the main modifications implemented can be found in previous BMR (June-May 2007).

An overview of Auxiliary Files being used as input for SCI_NL__2P products can be found in BMR May-June 2007.

With the activation of the SCIAMACHY Level 2 processor Version 5.01, the Fast Delivery processing of Level 2 products has operationally started at D-PAC. Level 1b near real time products and predicted instead of consolidated Auxiliary Data Files are used as input for the Level 2 off-line processor. With this new service ESA provides to the users within 24 hours from data acquisition the full SCIAMACHY Level 2 products.
Data monitoring of the SCIAMACHY Level 2 Fast Delivery processing chain is routinely performed and the corresponding Daily Reports are published on ESA's PCS web-pages at the link*:* http://earth.eo.esa.int/pcs/envisat/sciamachy/reports/daily/Level_2/

The main difference between SCIAMACHY off-line and Fast Delivery products is that the Restituted Attitude file cannot be used for processing. It also adopts Level 1b NRT data, which can differ in the used calibration measurements from the consolidated data. However, the difference between off-line processor products and Fast Delivery products is small in most cases.

8 LEVEL 2 OFF-LINE PRODUCT QUALITY MONITORING

8.1 Processor Configuration

8.1.1 Version

The current Level 2 off-line processing version is 5.01 since 09 February 2010 in alignment with the activation of the Level 1b IPF 7.03 in the off-line processing chain at D-PAC.

The new processor version introduces the following changes:

- M-Factors implemented in Level 1b-2 processing step
- Changes in the NO_2 retrieval settings
- New AAI algorithm
- Improvements in Limb retrieval
- Nadir SO_2 total columns for anthropogenic and "volcanic" scenarios
- Nadir BrO total columns
- Nadir H_2O total columns
- Nadir CO columns
- Nadir OClO slant columns
- Limb BrO profile
- Limb Cloud product

Note that the new version includes an update in the Level 2 data format.

The Product Specification corresponding to the Level 2 off-line processor 5.01 is Volume 15, issue 3L, version 1.1 *[2]* and can be found at
http://earth.eo.esa.int/pub/ESA_DOC/ENVISAT/Vol15_Sciamachy_3L_1.1.pdf

The Product Quality Disclaimer at
http://envisat.esa.int/dataproducts/availability/disclaimers/SCI_OL__2P_Disclaimers.pdf
has been updated in relation to the new processor version 5.01 and describes known artefacts.

SCI_OL__2P products contain geo-located vertical column amounts of trace gases retrieved from Nadir measurements, as well as stratospheric Limb profiles of O_3, NO_2 and BrO. Additionally fractional cloud coverage, cloud-top height, and cloud optical thickness are derived and provided as product to the user. The major upgrades with respect to prior processor versions are summarised in Table 8.1.

Processor Version	Description	Proc Centre	Date	Start Orbit
5.01	Main processor changes: • Nadir MDS now contain additional trace gas columns: SO2, BrO, H2O, OClO and CO. • Limb MDS now contain the trace gas profiles of BrO. • Limb Cloud MDS Contains height resolved indicators for cloud presence and type (water clouds, PSCs and NLCs).	D-PAC	23-JAN-2010	41295
3.01	Main processor changes: • Updated SACURA cloud algorithm • Offset applied in NO_2 slant column processing was removed • Number of retrieved profiles per state was set from one to four (4) • Cloud and Aerosol MDS are filled with the next valid value instead of being set to zero • Molecular Ring correction applied on NADIR O_3 slant column density Non-compliance corrections: • Inter change of Pressure and Temperature values in LIMB MDS • Erroneous Cloud and Aerosol Quality Flags • AAI erroneously set to zero in Cloud and Aerosol MDS • Scaling of too large NO_2 error estimate	D-PAC	23-SEP-2007	29092

3.00	Main processor changes: • Nadir UV/Visible algorithm for ozone and NO_2 is based on the GDP (GOME Data Processor) Version 4.0 • Nadir UV/Visible algorithm for cloud-top height and cloud optical thickness based on the SACURA algorithm • Limb UV/Visible products: Stratospheric Ozone and NO_2 profiles • Improved pointing performance through the use of the ENVISAT Restituted Attitude information in the consolidated Level 1b product	D-PAC	03-MAY-2006	21824

Table 8-1: Level 2 off-line Processor Configuration.

8.1.2 Anomalies

No significant anomalies in this reporting period.

8.1.3 Auxiliary Data Files

Input for Level 2 off-line processing is the so-called Initialization File.
For processor version 5.01 a new Initialization file became active which is

SCI_IN__AXNPDE20090615_120000_20090615_000000_20991231_235959

This ADF is usually changed only in case of a processor upgrade.

8.2 Monitoring results

8.2.1 Nadir: NO_2 consistency checking

The world map plots of Nadir NO_2 vertical column density (VCD) values averaged over one month are generated from the SCI_OL__2P Nadir products. Figures 8-1 and 8-3 show the monthly world map plots for July and August 2010.

Figures 8-2 and 8-4 show the VCD errors for the monthly average plots. The errors are given in absolute values (molec/cm^2). Generally the equator region has NO_2 values with higher errors.
An overall reduction of the error associated to NO_2 mean VCDs has been obtained with the new processor version 5.01.

High concentration of NO_2 is expected over industrial regions, such as over North America, especially the East coast, over central Europe, China and South Africa, which is reflected in the world maps.

8.2.1.1 Nadir: VCD NO_2 map July 2010

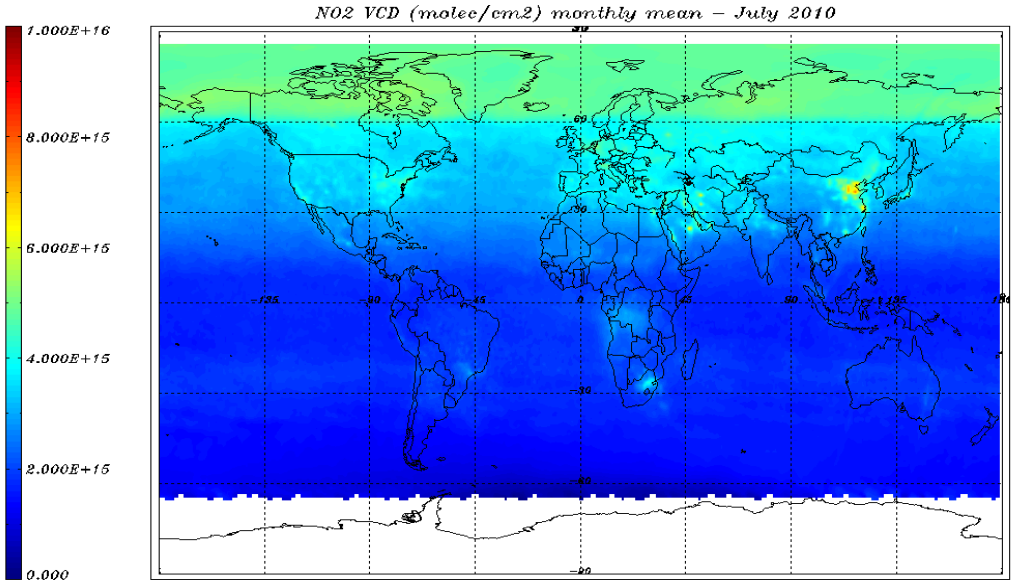


Figure 8-1: NO_2 VCD (molec/cm^2) world map for 01 - 31 July 2010 – monthly average.

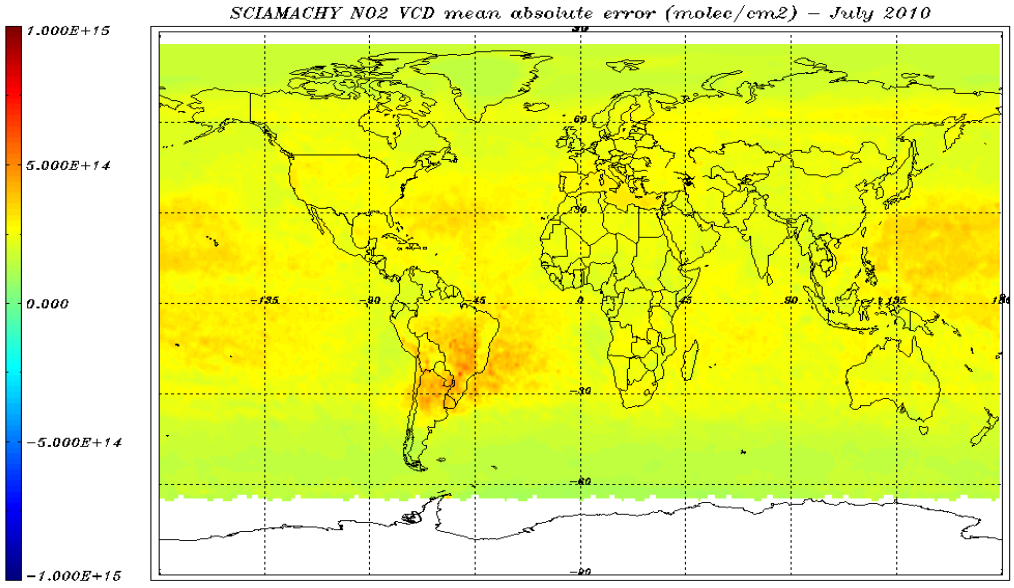


Figure 8-2: NO_2 VCD error (molec/cm^2) for 01 - 31 July 2010 - monthly average.

8.2.1.2 Nadir: VCD NO2 map August 2010

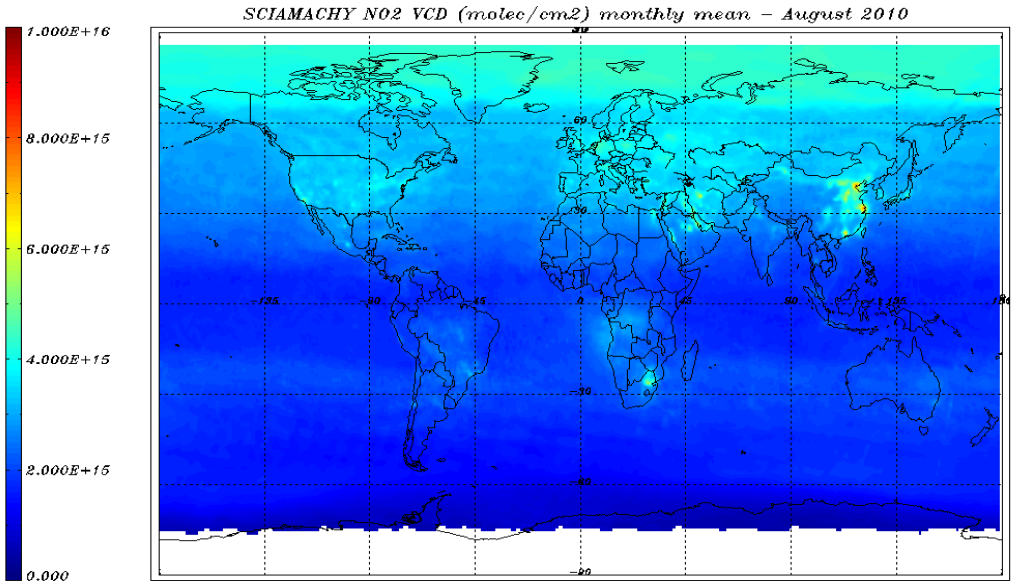


Figure 8-3: NO_2 VCD (molec/cm^2) world map for 01 – 31 August 2010 – monthly average.

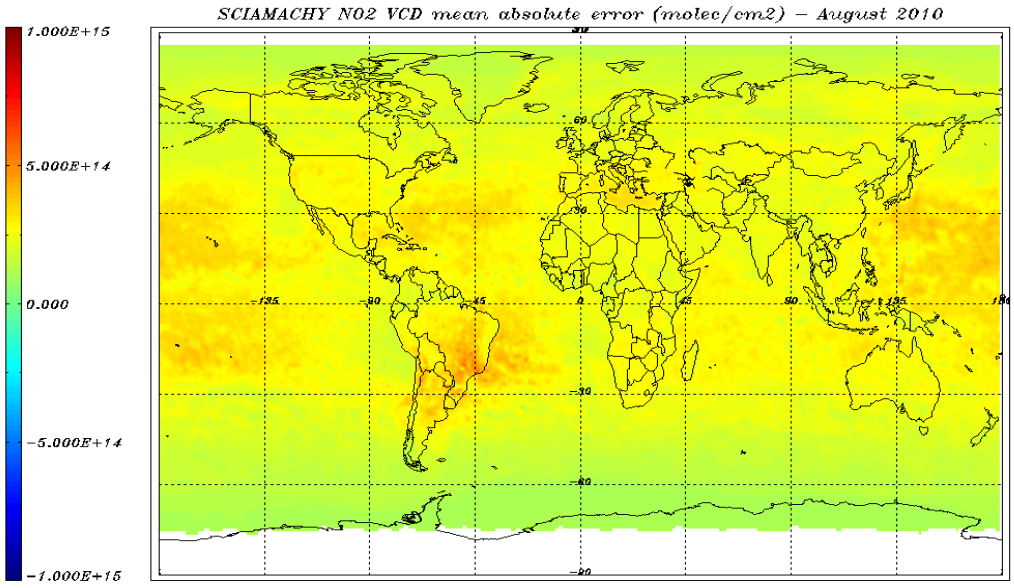


Figure 8-4: NO_2 VCD error (molec/cm^2) for 01 – 31 August 2010- monthly average.

8.2.2 Nadir: O_3 consistency checking

Analogous to the NO_2 world maps, O_3 vertical column density (VCD) values averaged over one month are generated from the SCI_OL__2P Nadir products and plotted on a world map. Figures 8-5 and 8-7 show the ozone distribution converted to Dobson units for July and August 2010.
The VCD error as monthly average plots is shown in Figures 8-6 and 8-8as relative fraction.

8.2.2.1 Nadir: VCD O_3 map July 2010

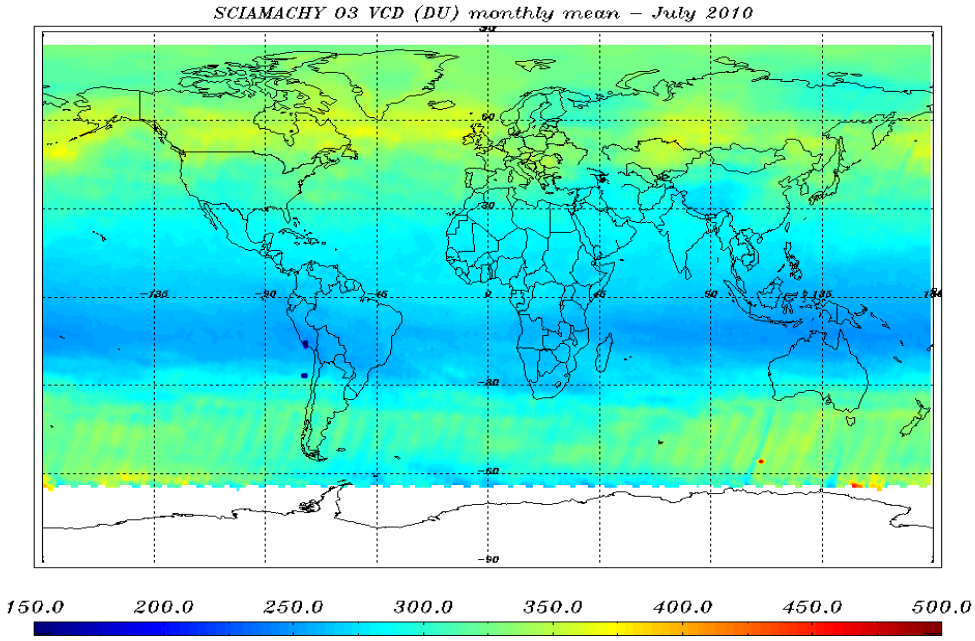


Figure 8-5: O_3 VCD (DU) world map for 01 - 31 July 2010 – monthly average.

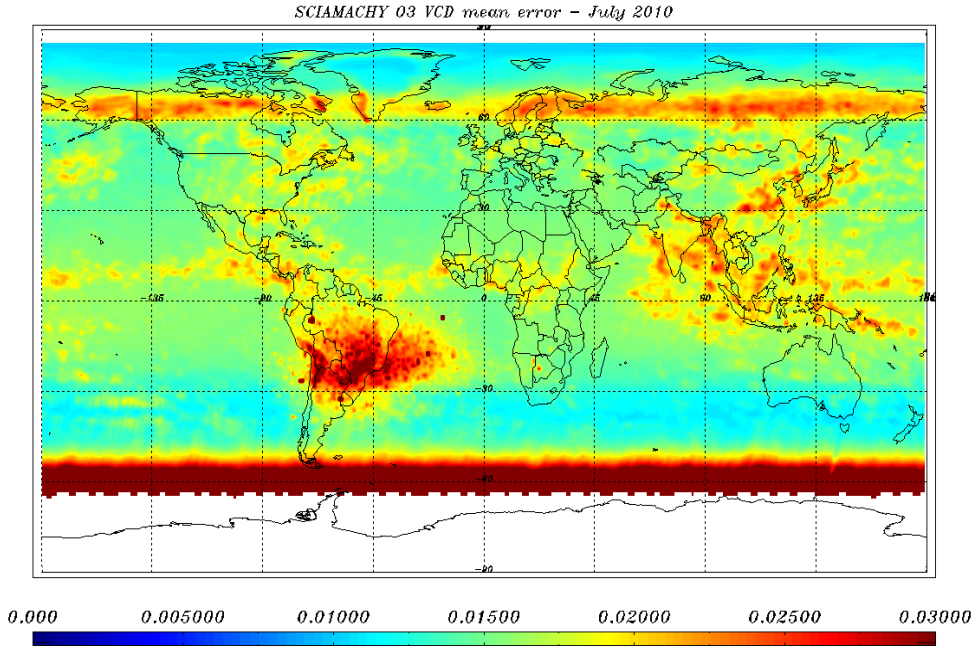


Figure 8-6: O3 VCD error for 01 - 31 July 2010 - monthly average.

8.2.2.2 Nadir: VCD O3 map August 2010

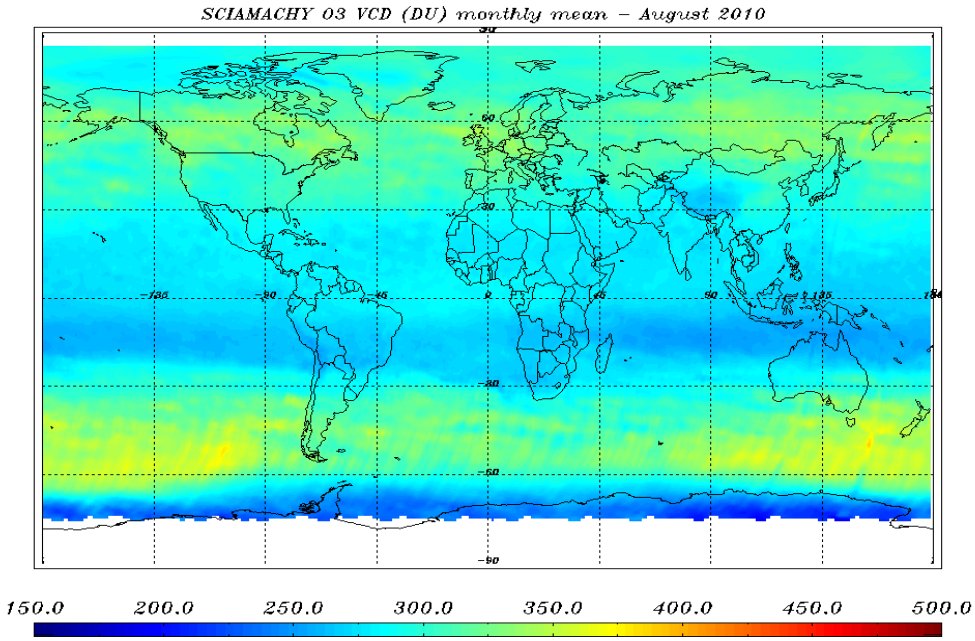


Figure 8-7: O_3 VCD (DU) world map for 01 - 31 August 2010 – monthly average.

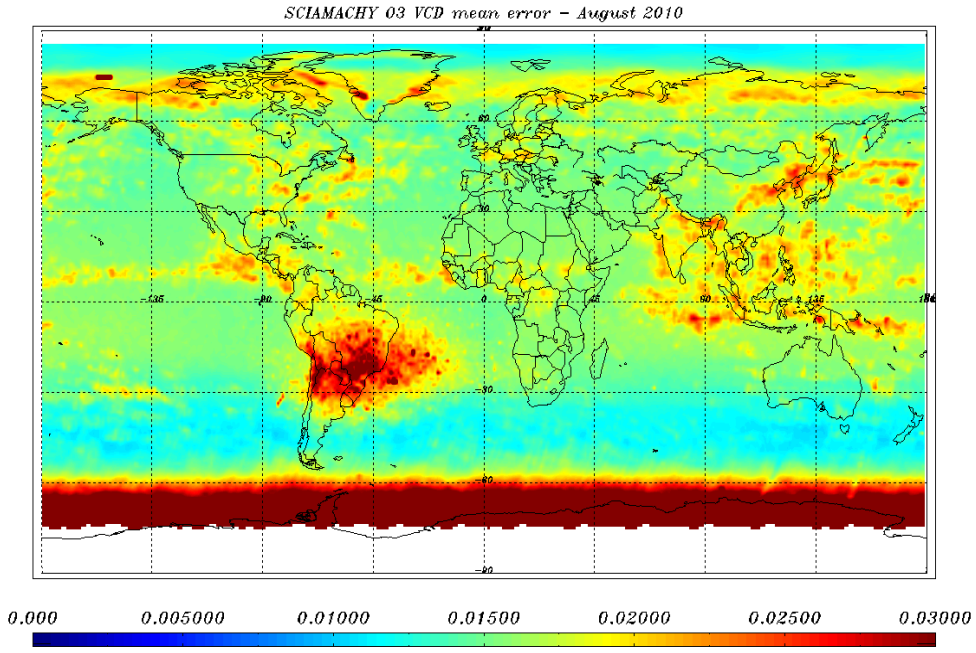


Figure 8-8: O_3 VCD error for 01- 31 August 2010 - monthly average.

8.2.3 Nadir: H_2O consistency checking

The world map plots of Nadir H_2O vertical column density (VCD) values in g/cm^2 averaged over one month are generated from the SCI_OL__2P Nadir products version 5.01. Figures 8-9 and 8-11 show the monthly plots for July and August 2010.
Figures 8-10 and 8-12 show the VCD error for the monthly average plot. Errors are absolute values (g/cm^2).

In the plots, data over high mountain areas (Himalayas and the Andes range) are masked out by the processor's internal quality checks. No correction for surface elevation is performed.

Please note that these plots are preliminary results after the implementation of the new processor version and are still under review.

8.2.3.1 Nadir: VCD H_2O map July 2010

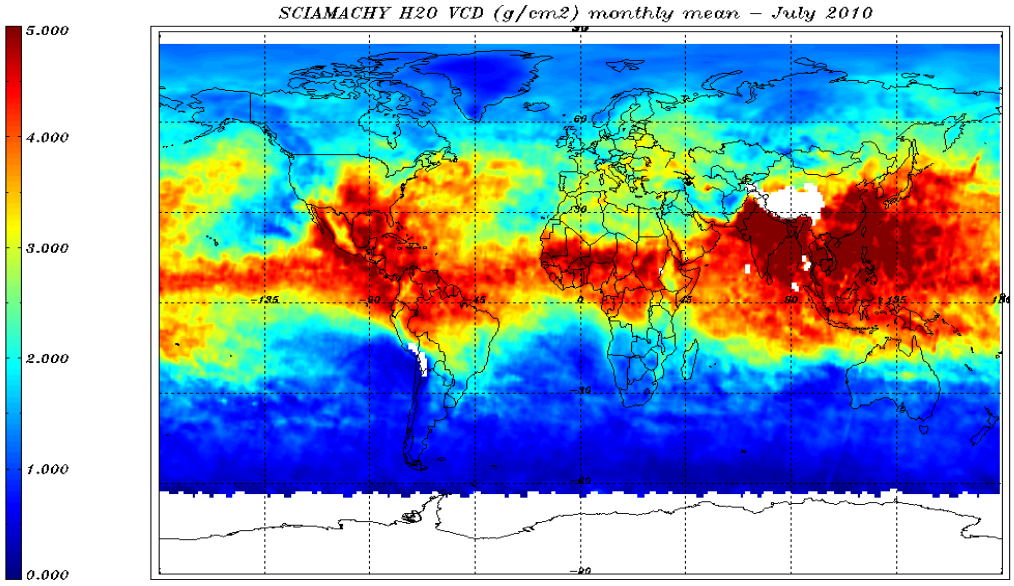


Figure 8-9: H2O VCD (g/cm^2) world map for 01 - 31 July 2010 – monthly average.

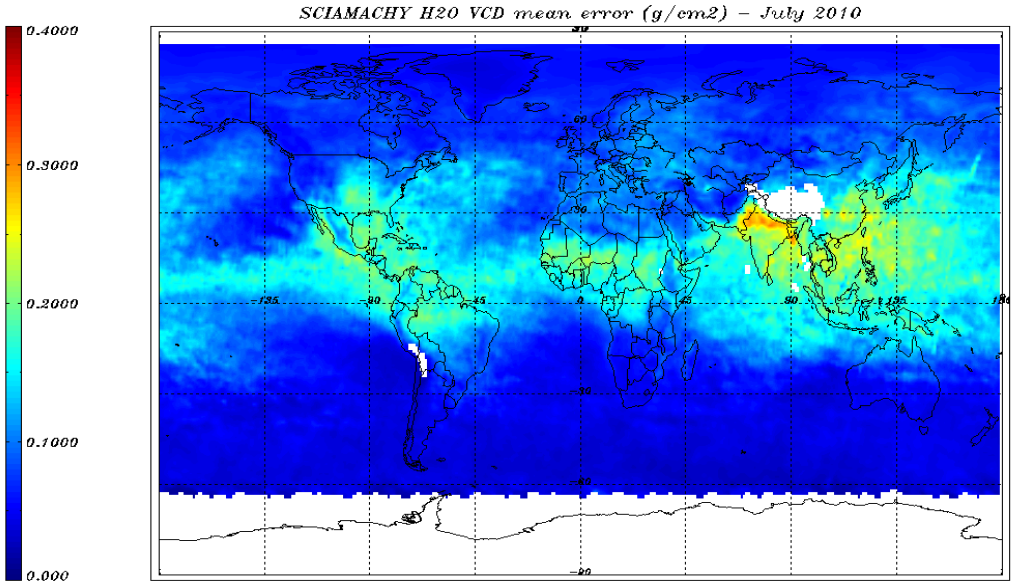


Figure 8-10: H2O VCD (g/cm^2) error for 01 - 31 July 2010 - monthly average.

8.2.3.2 Nadir: VCD H_2O map August 2010

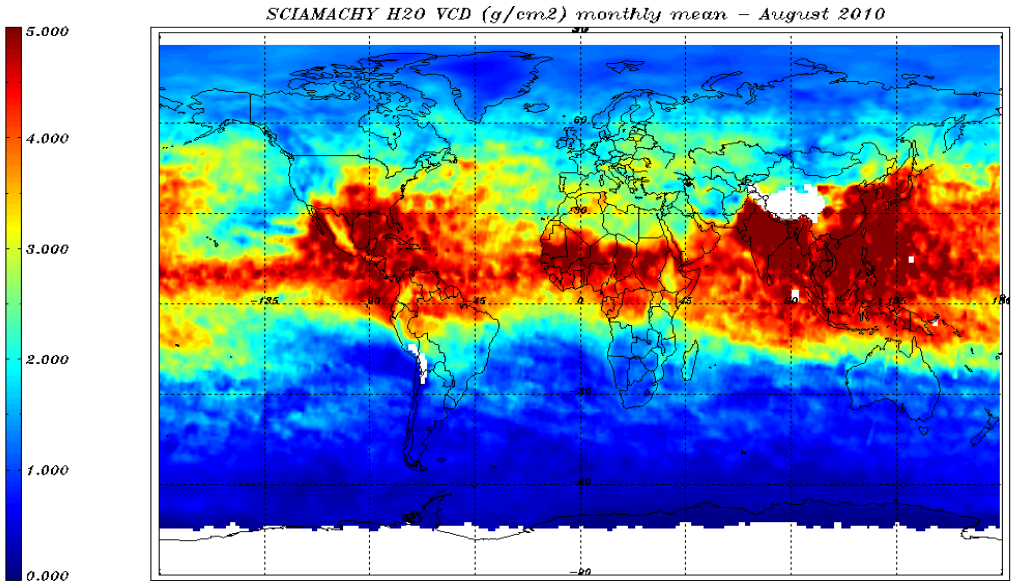


Figure 8-11: H_2O VCD (g/cm^2) world map for 01 – 31 August 2010 – monthly average.

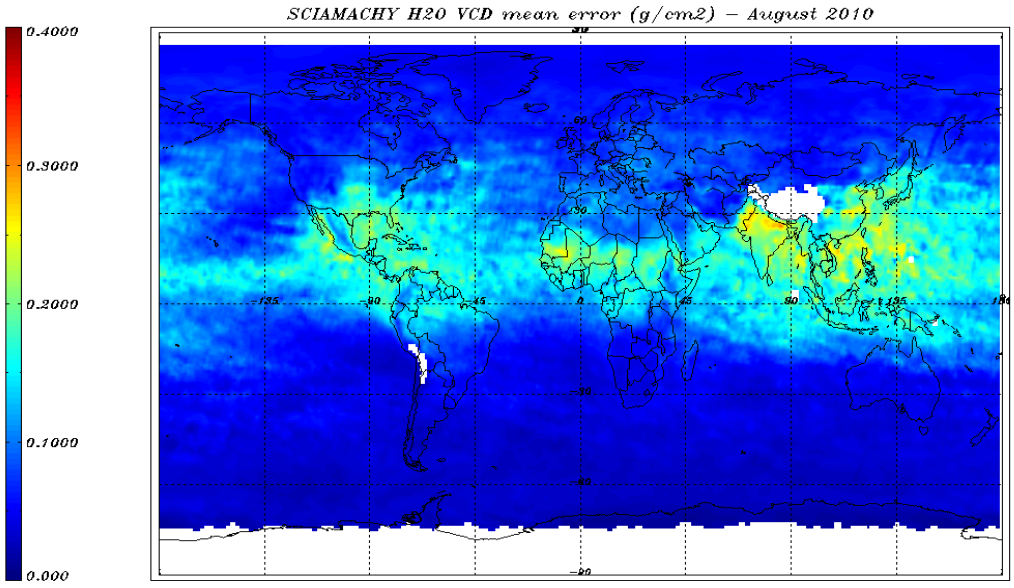


Figure 8-12: H_2O VCD (g/cm^2) error for 01 – 31 August 2010- monthly average.

8.2.4 Nadir: BrO consistency checking

The world map plots of Nadir BrO vertical column density (VCD) values averaged over one month are generated from the SCI_OL__2P Nadir products version 5.01. Figures 8-13 and 8-15 show the monthly world map plots for July and August 2010.

Figures 8-14 and 8-16 show the VCD errors for the monthly average plots. Errors are given in absolute values (molec/cm^2).

Large emissions of inorganic bromine are expected in the Tropospheric Polar Regions at the end of the winter (bromine explosion event) and in the troposphere and possibly in the stratosphere as a consequence of active volcanoes. Low values are present in correspondence with the SAA.

Please note that these plots are preliminary results after the implementation of the new processor version and are still under review.

For year 2002 the BrO column densities are substantially too low with a lot of negative values. We recommend users not to use the 2002 BrO data in the current implementation.

8.2.4.1 Nadir: VCD BrO map July 2010

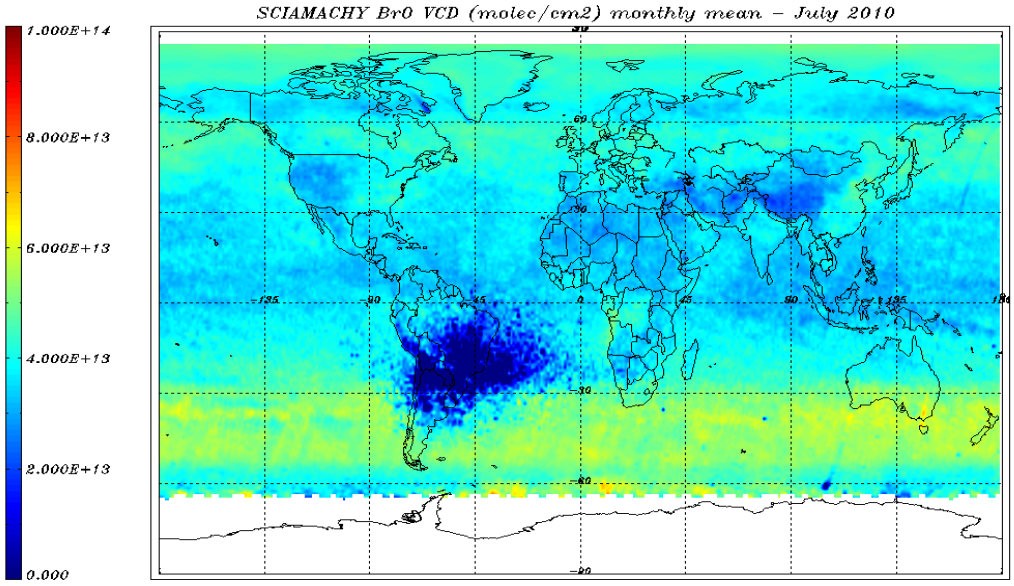


Figure 8-13: BrO VCD (molec/cm^2) world map for 01 – 31 July 2010 – monthly average.

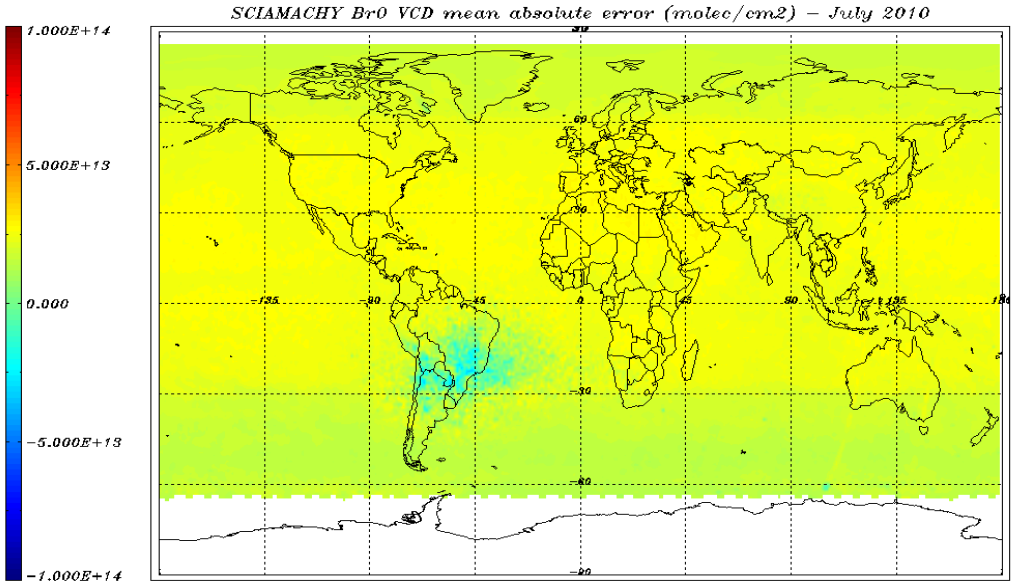


Figure 8-14: BrO VCD error (molec/cm^2) for 01 – 31 July 2010- monthly average.

8.2.4.2 Nadir: VCD BrO map August 2010

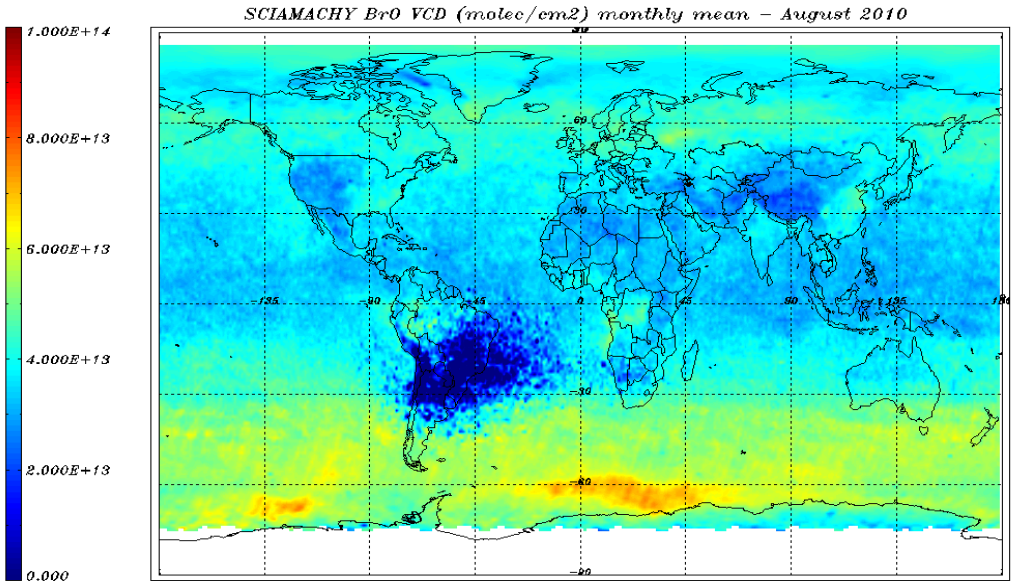


Figure 8-15: BrO VCD (molec/cm^2) world map for 01 – 31 August 2010 – monthly average.

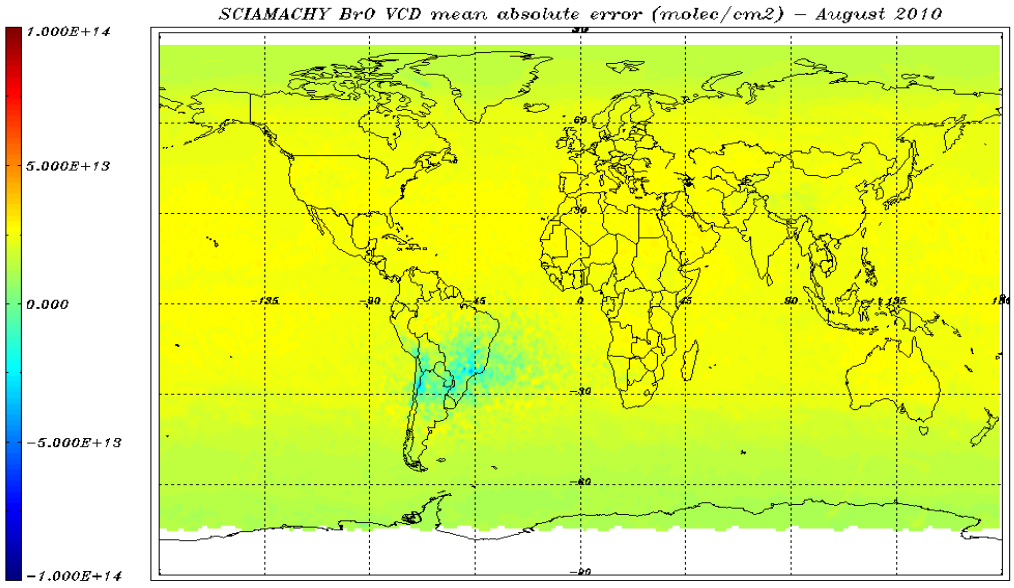


Figure 8-16: BrO VCD error (molec/cm^2) for 01 – 31 August 2010- monthly average.

8.2.5 Nadir: SO_2 consistency checking

The world map plots of Nadir SO_2 vertical column density (VCD) values in molec/cm^2 averaged over one month are generated from the SCI_OL__2P Nadir products version 5.01. Each Level 2 product now contains one MDS for an anthropogenic scenario (SO_2 present in the boundary layer) and one MDS for the volcanic scenario (SO_2 layer between 10 and 11 km).

Since SO_2 distribution varies to a large degree between an anthropogenic scenario (pollution dominated) and a volcanic scenario, the AMF cannot be determined for both with a single climatology. Two types of AMF for the calculation of the "anthropogenic" SO_2 vertical columns and the "volcanic" ones are derived assuming a constant profile shape for two typical scenarios:

- a profile with 1 DU of SO_2 from surface to 1 km height simulating an Anthropogenic Pollution scenario;
- a profile with 10 DU of SO_2 between a 10 and 11 km simulating a volcanic eruption.

Accordingly, two types of SO_2 vertical columns - anthropogenic and volcanic - are computed and written into two different MDSs of the Level 2 products.

Both retrievals use the same background subtracted slant column as input, calculated from a reference sector over the Pacific Ocean as a pollution free correction.

Figures 8-17, 8-19, 8-21 and 8-23 show the monthly world map plots for anthropogenic and volcanic vertical columns for July and August 2010. Figures 8-18, 8-20, 8-22 and 8-24 show the VCD errors for the monthly average plots. Errors are given in absolute value (molec/cm^2).

Please note that these plots are preliminary results after the implementation of the new processor version and are still under review. The operational SO2 product picks-up the main relevant volcanic features, but there is a problem in the fit leading to a low bias in the slant columns over continents and very high values encountered in some areas of the Northern Hemisphere. At high latitudes, VCDs are strongly affected by negative values, presumably resulting from problems with the reference sector subtraction. Due to the poor results, it is recommended not to use the current version of the Slant Column and anthropogenic Total Column for quantitative studies. Usage of the volcanic Total Column as indicator of large volcanic eruptions seems to be feasible.

8.2.5.1 Nadir: SO2 Anthropogenic scenario - July 2010

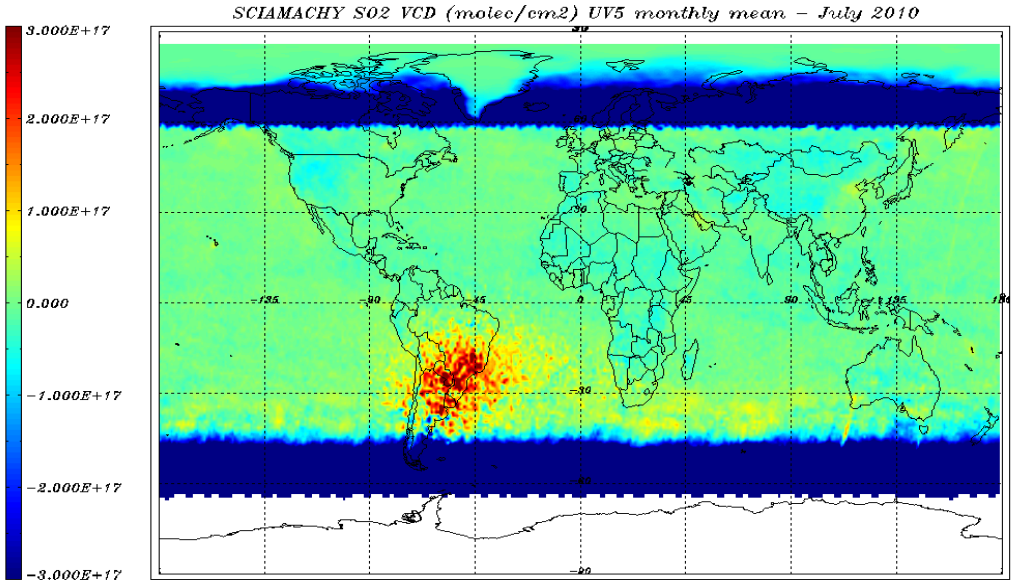


Figure 8-17: SO_2 VCD (molec/cm^2) world map for 01 –31 July 2010 – monthly average.

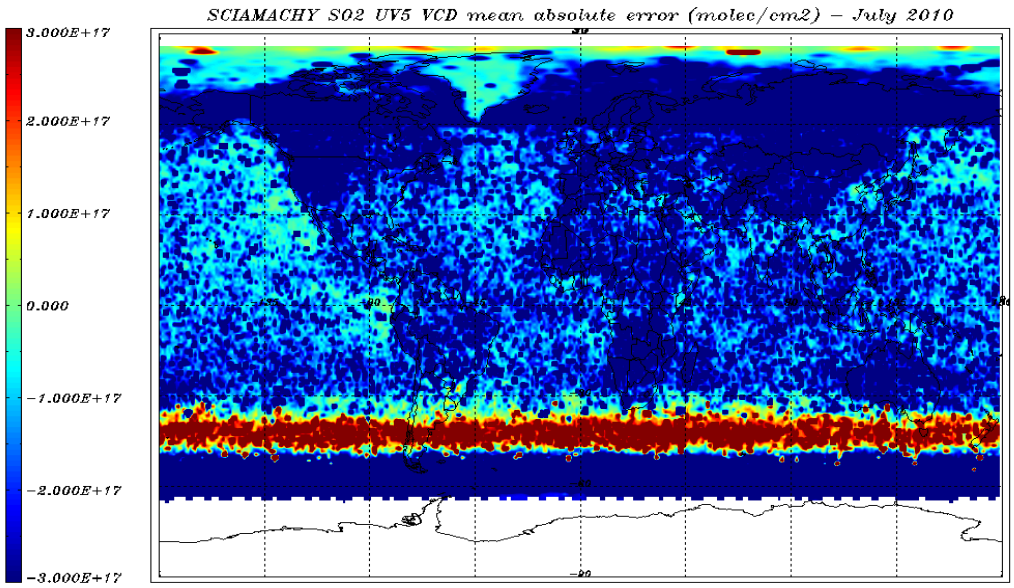


Figure 8-18: SO_2 VCD error (molec/cm^2) for 01 –31 July 2010- monthly average.

8.2.5.2 Nadir: SO_2 Anthropogenic scenario - August 2010

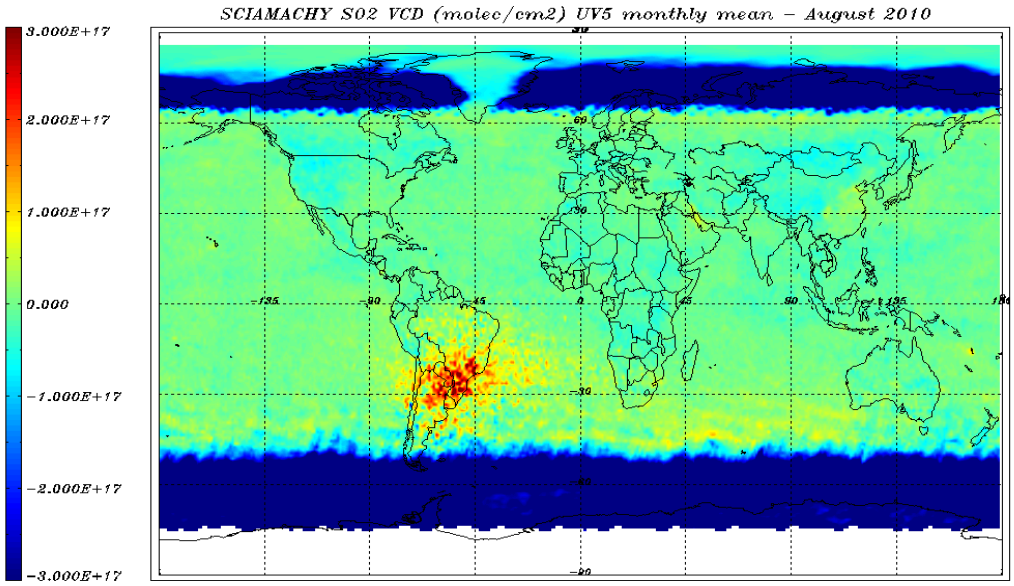


Figure 8-19: SO_2 VCD (molec/cm^2) world map for 01 – 31 August 2010 – monthly average.

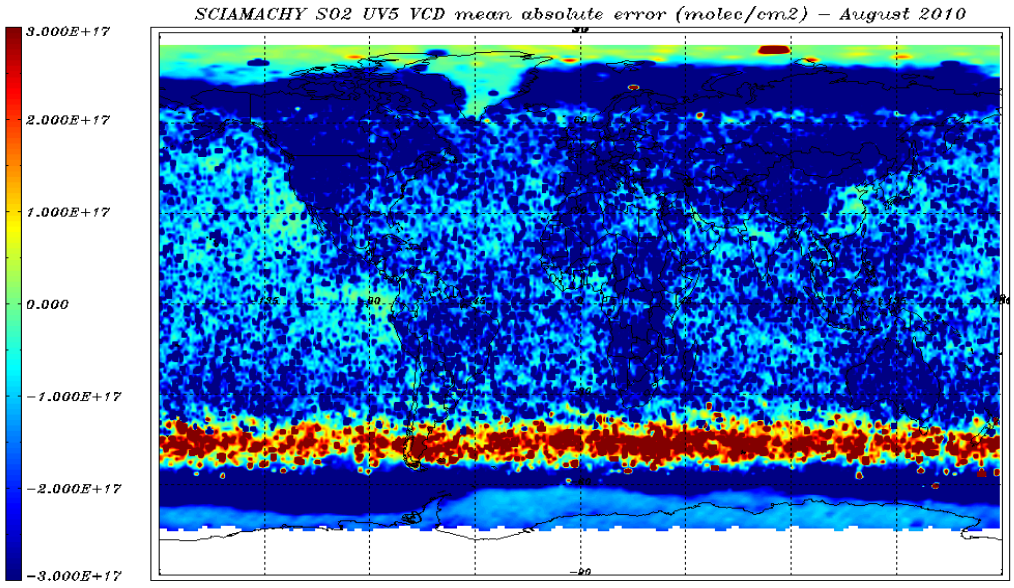


Figure 8-20: SO_2 VCD error (molec/cm^2) for 01 – 31 August 2010- monthly average.

8.2.5.3 Nadir: SO_2 Volcanic scenario - July 2010

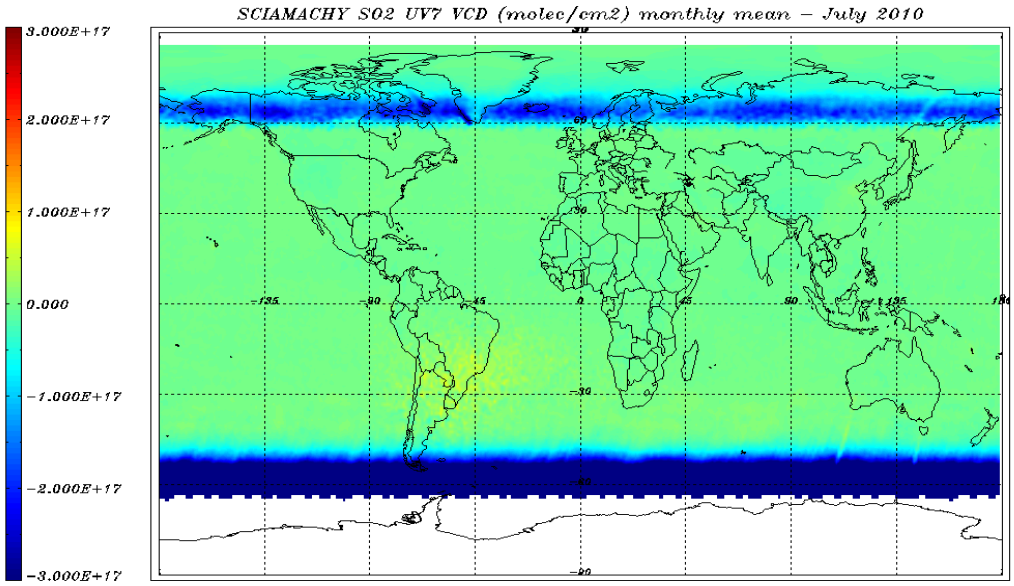


Figure 8-21: SO_2 VCD (molec/cm^2) world map for 01 –31 July 2010 – monthly average.

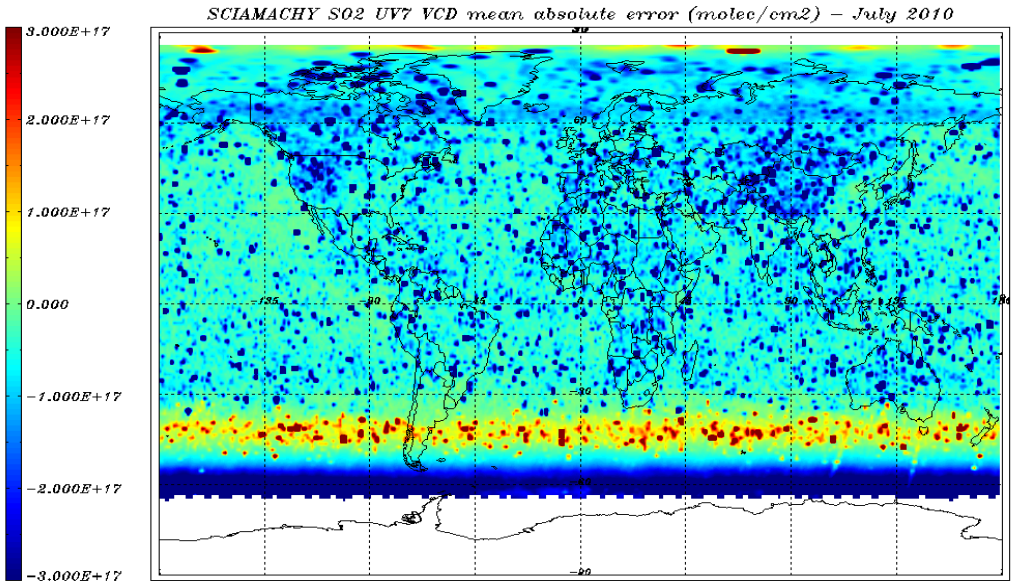


Figure 8-22: SO_2 VCD error (molec/cm^2) for 01 – 31 July 2010 – monthly average.

8.2.5.4 Nadir: SO_2 Volcanic scenario - August 2010

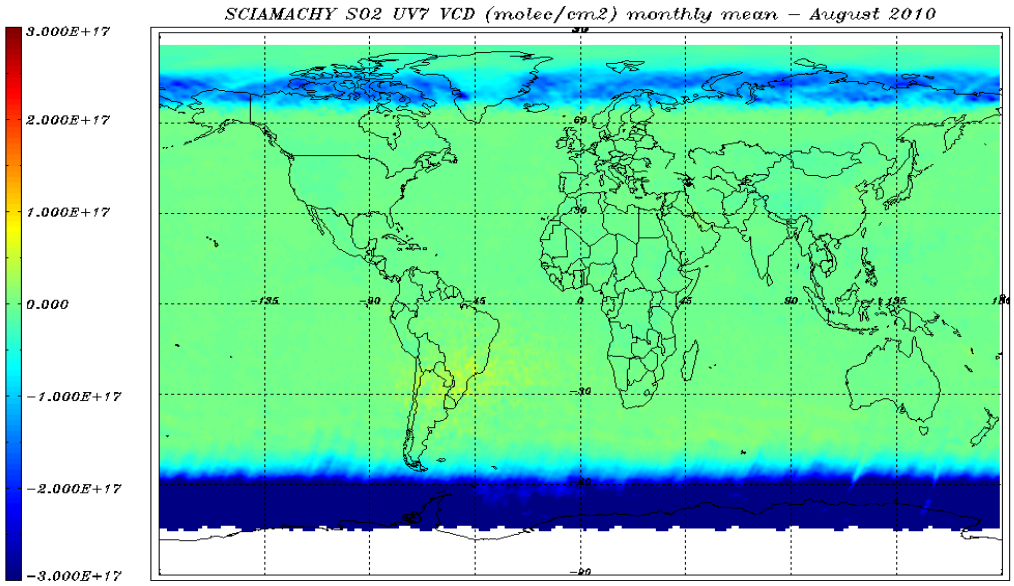


Figure 8-23: SO_2 VCD (molec/cm^2) world map for 01 – 31 August 2010 – monthly average.

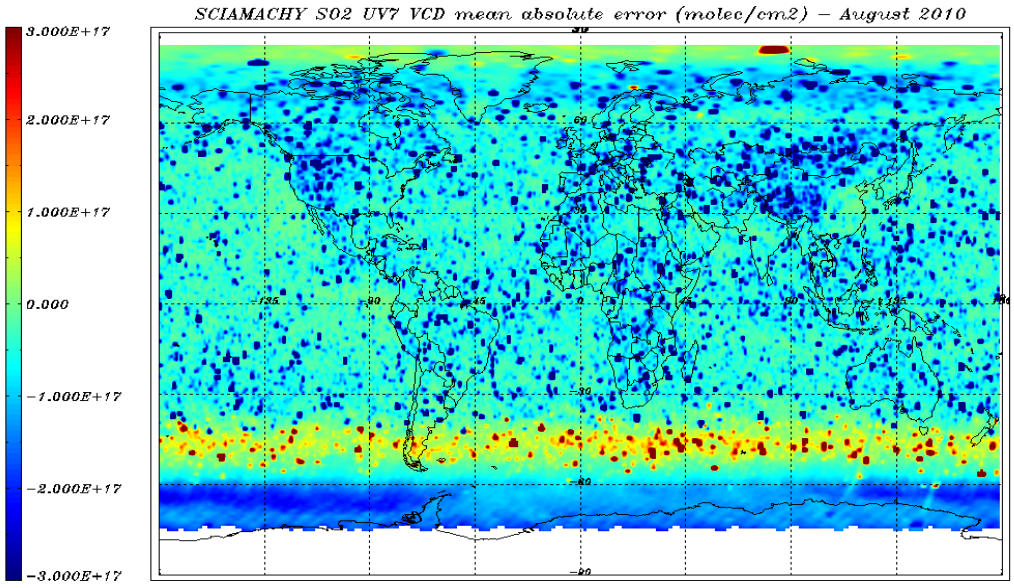


Figure 8-24: SO_2 VCD error (molec/cm^2) for 01 – 31 August 2010 – monthly average.

8.2.6 Nadir: OClO consistency checking

The polar maps of Nadir OClO slant column density (SCD) values averaged over one month are generated from the SCI_OL__2P Nadir products version 5.01.
Figure 8-25 and 8-27 shows the monthly SCD values for August 2010 over the Northern and the Southern Hemisphere respectively. Figures 8-26 and 8-28 show the corresponding SCD absolute errors for the monthly average plots.

Computation of VCD is difficult for the rapid photochemistry of OClO. The vertical column given in the product does not contain any correction for photochemical effects and should thus not be used as given.

Significant amounts of OClO are expected only in the activated polar vortex.

Please note that these plots are preliminary results after the implementation of the new processor version and are still under review.

8.2.6.1 Nadir: SCD OClO maps July 2010

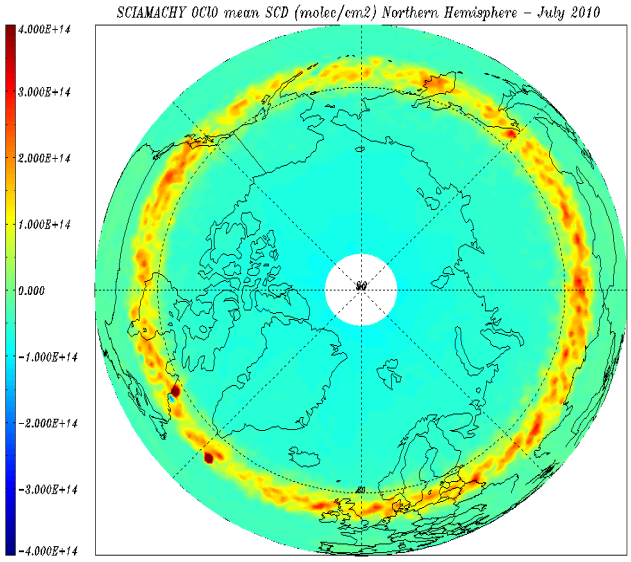


Figure 8-25: OClO SCD (molec/cm^2) for 01 – 31 July 2010 – monthly average over the Northern Hemisphere.

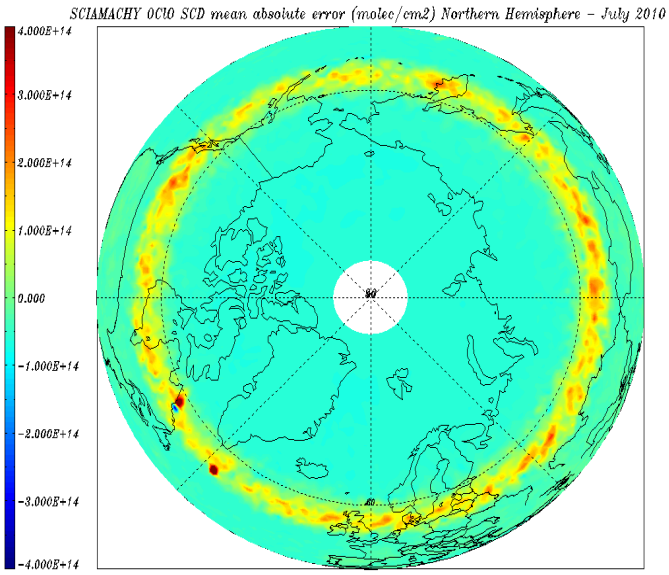


Figure 8-26: OClO SCD error (molec/cm^2) for 01 – 31 July 2010- monthly average over the Northern Hemisphere.

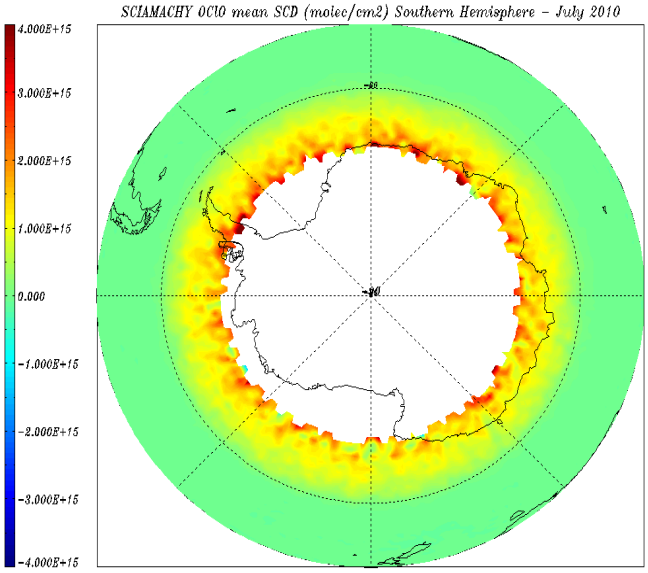


Figure 8-27: OClO SCD (molec/cm^2) for 01 – 31 July 2010 – monthly average over the Southern Hemisphere.

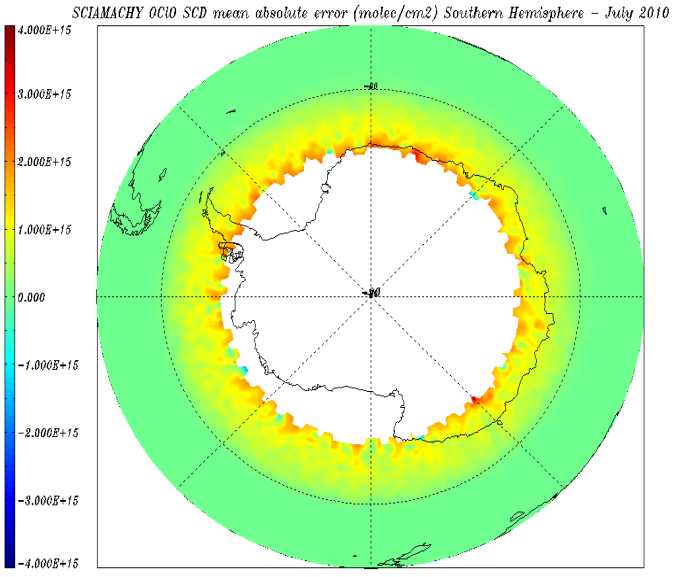


Figure 8-28: OClO SCD error (molec/cm^2) for 01 – 31 July 2010- monthly average over the Southern Hemisphere.

8.2.6.2 Nadir: SCD OClO maps August 2010

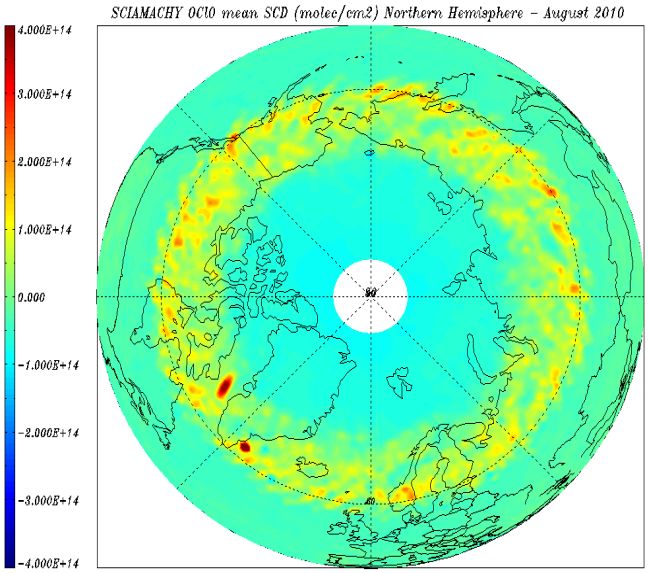


Figure 8-29: OClO SCD (molec/cm^2) for 01 – 31 August 2010 – monthly average over the Northern Hemisphere.

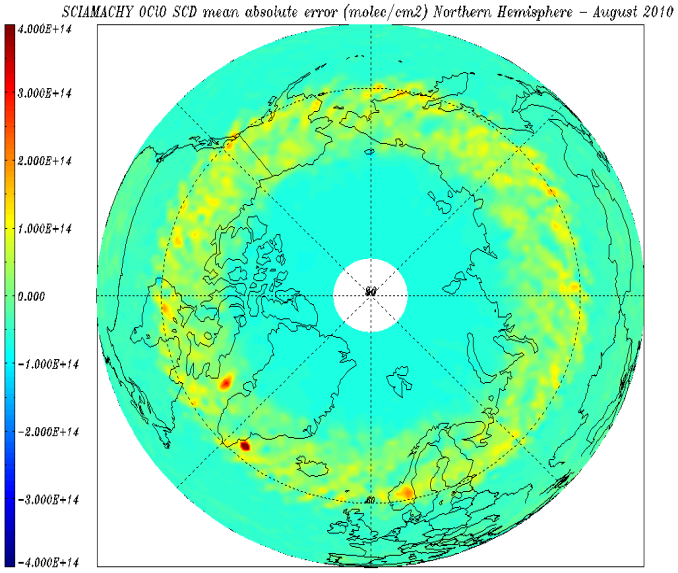


Figure 8-30: OClO SCD error (molec/cm^2) for 01 – 31 August 2010- monthly average over the Northern Hemisphere.

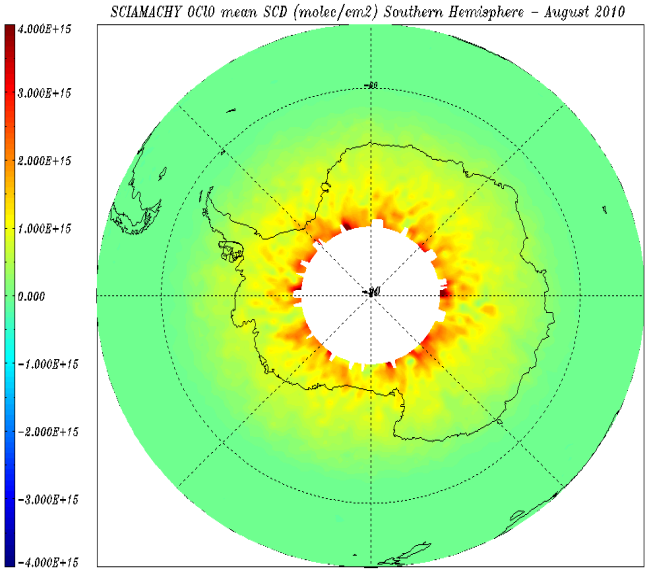


Figure 8-31: OClO SCD (molec/cm^2) for 01 – 31 August 2010 – monthly average over the Southern Hemisphere.

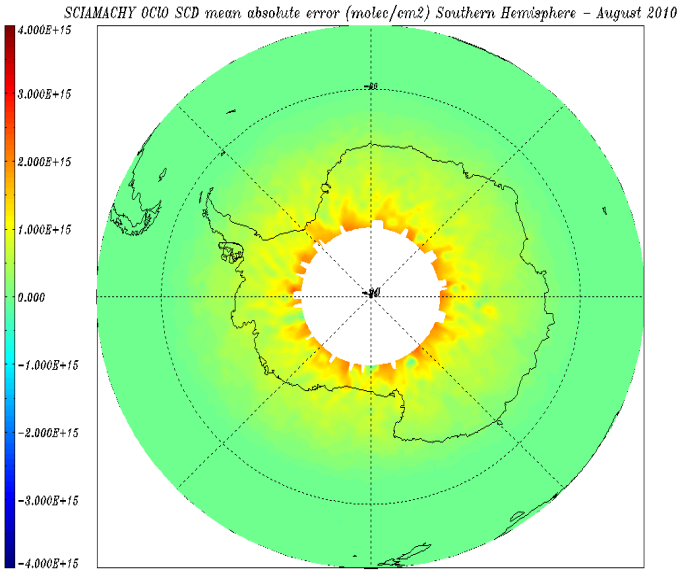


Figure 8-32: OClO SCD error (molec/cm^2) for 01 – 31 August 2010- monthly average over the Southern Hemisphere.

8.2.7 Nadir: CO consistency checking

Due to erroneous retrieval settings in the operational software, the CO column densities from Level 2 version 5.01 products are recommended not to be used.

8.2.8 Limb: Ozone profile averages

This paragraph reports on the monitoring of SCIAMACHY limb profiles on a monthly basis, showing the results for Ozone limb profiles binned for two tangent height regions.

Starting with processor version 5.01, a new limb retrieval grid of 27 tangent altitudes has been adopted instead of the 19 values grid used by processor 3.01. As a consequence, the limb profile average plots in this section use different altitude bins with different thickness according to the new product's configuration for limb measurements.

In particular, for the O_3 limb VMR profile extracted from Level 2 products version 5.01, the average plots are reported for the following two tangent height bins

- 22.75 – 24.5 km
- 36.75 – 38.5 km.

The data of the first half of each month (calendar days 1 - 15) and the second half (calendar days 16 - 31) are averaged for selected tangent heights into geo-location bins of 10 degrees longitude and 5 degrees latitude. The binning algorithm uses a single longitude and latitude value for the entire profile, being the value for the middle of the integration time as reported in the Geo-location Limb Dataset. The corresponding error is averaged as well.
The world maps of the averaged Ozone values show comparably low errors over the SAA region, which is not as expected. Investigation showed that the low SAA errors result from irregular conditions of the limb retrieval in that region.
Figures from 8-33 to 8-36 show the results for the months of July and August 2010 and for the two different tangent height regions.

8.2.8.1 Ozone limb profiles July 2010

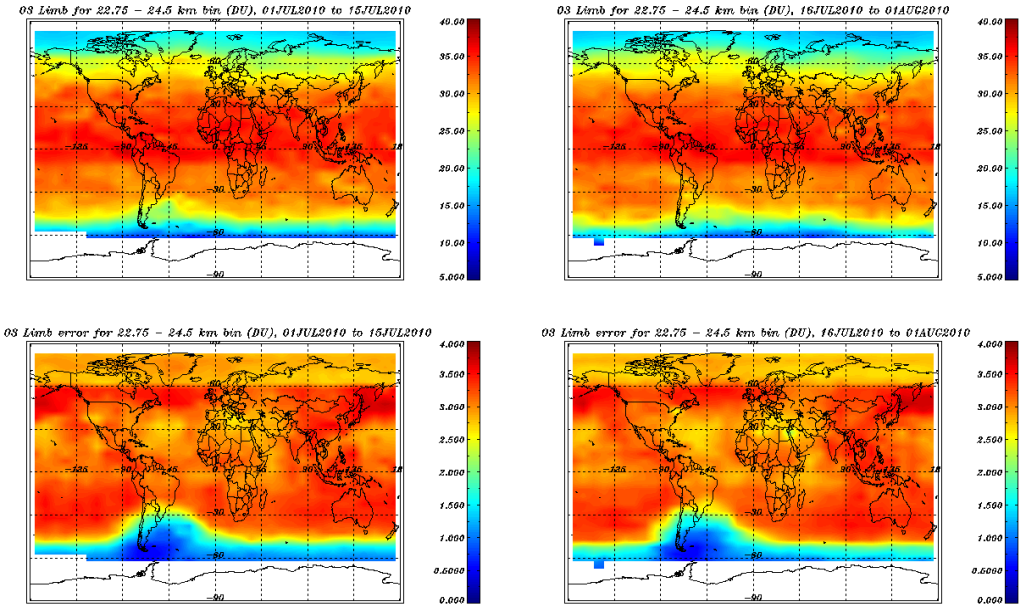


Figure 8-33: Limb Ozone profiles, binned over 22.75 – 24.5 km, July 2010.

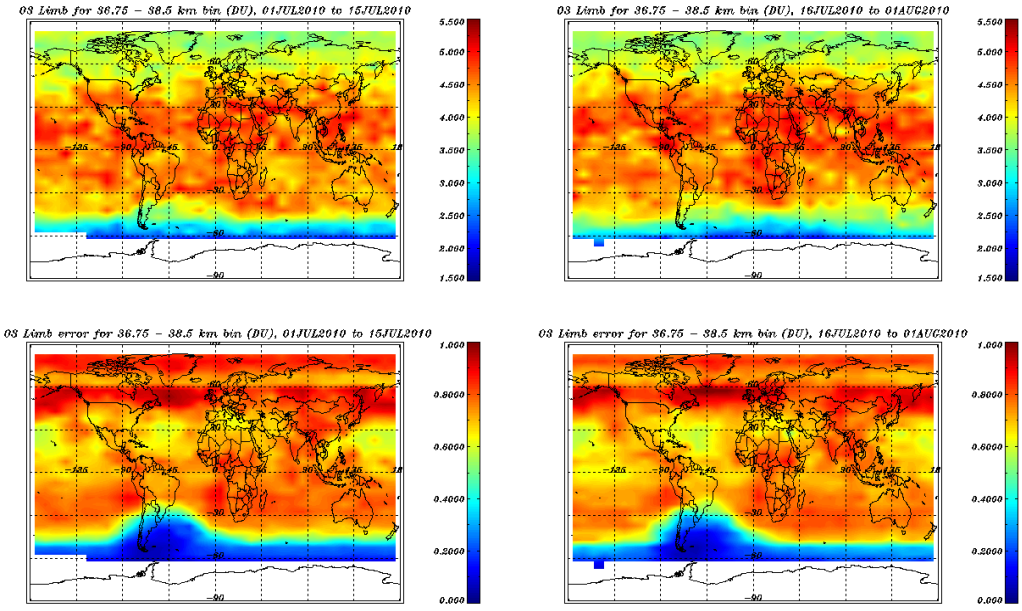


Figure 8-34: Limb Ozone profiles, binned over 36.75 – 38.5 km, July 2010.

8.2.8.2 Ozone limb profiles August 2010

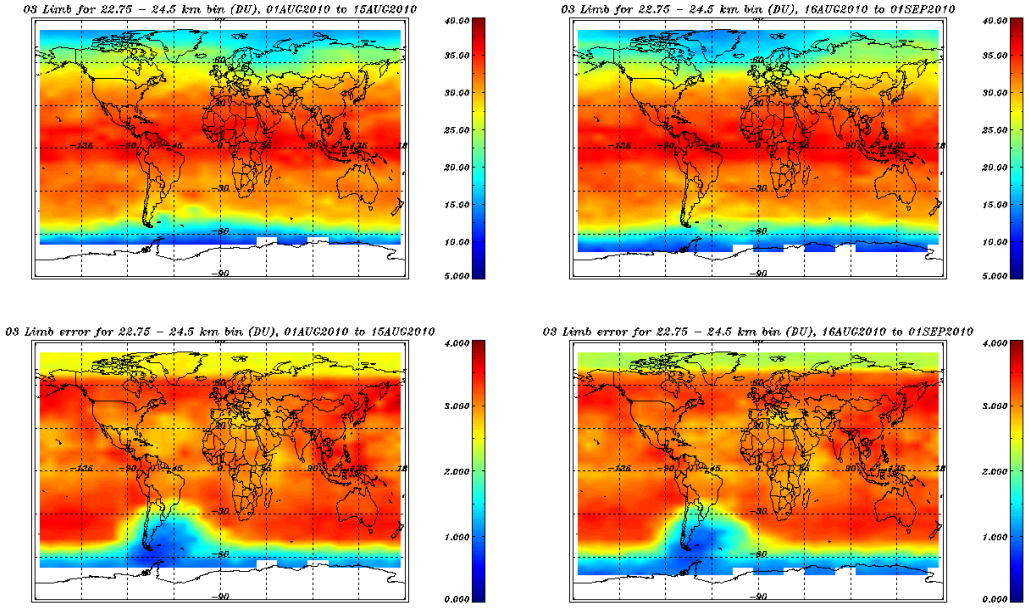


Figure 8-35: Limb Ozone profiles binned over 22.75 – 24.5 km, August 2010.

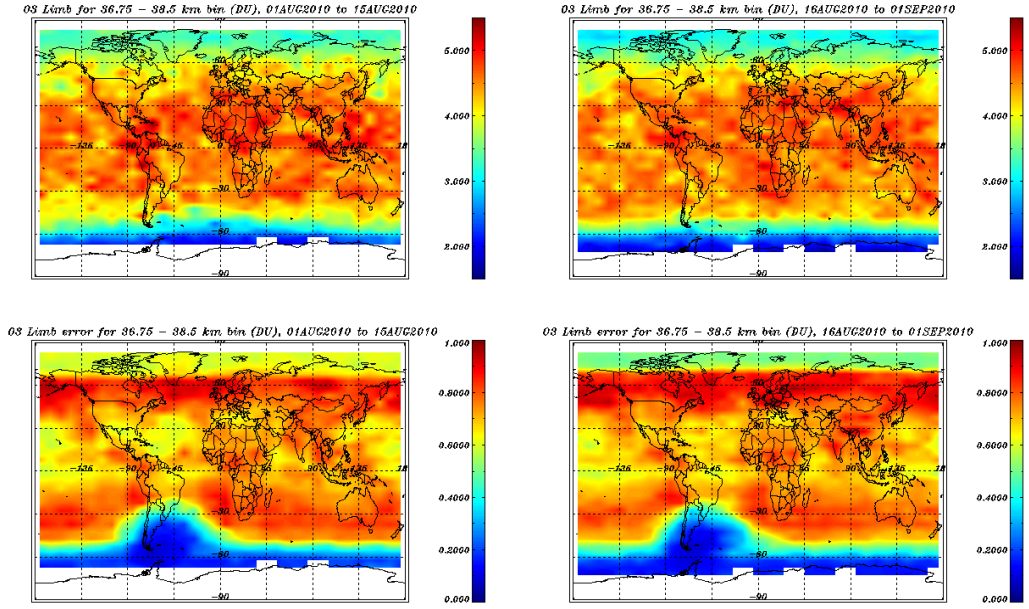


Figure 8-36: Limb Ozone profiles binned over 36.75 – 38.5 km, August 2010.

8.2.9 Limb: NO_2 profile averages

Analogous as for the limb Ozone profiles monthly averages for NO_2 limb averages were generated. For the new Level 2 products version 5.01, the tangent height region chosen is:

- 24.5-26.25 km.

As for the ozone averages the data of the first half of each month (calendar days 1 - 15) and the second half (calendar days 16 - 31) are averaged for selected tangent heights into geo-location bins of 10 degrees longitude and 5 degrees latitude. The binning algorithm used is the same as the described in 8.2.3. The corresponding error is averaged as well. Figures 8-37 and 8-38 show the results for the months of July and August 2010 respectively.

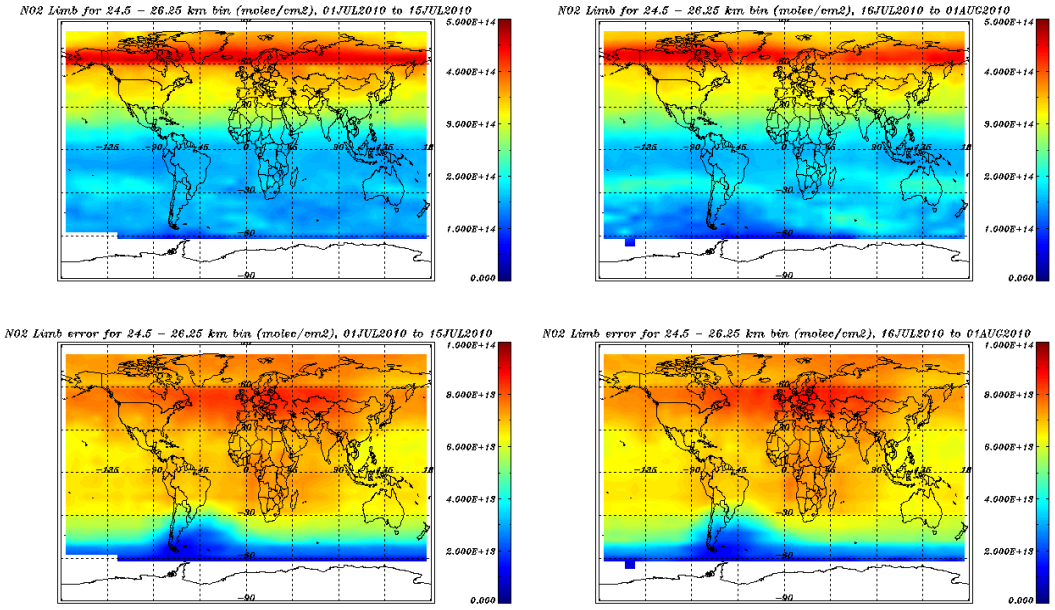


Figure 8-37: Limb NO_2 profiles binned over 24.5 – 26.25 km, July 2010.

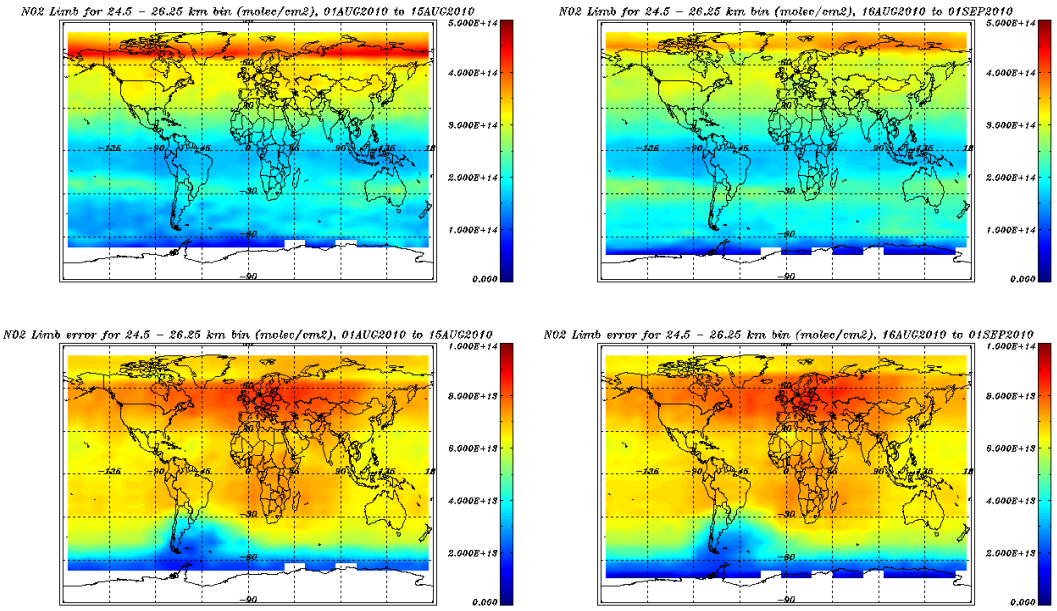


Figure 8-38: Limb NO_2 profiles binned over 24.5 – 26.25 km, August 2010.

8.2.10 Limb: BrO profile averages

Analogous as for the limb Ozone and NO_2 profiles, monthly averages for BrO limb profiles were generated. The tangent height region chosen is:

- 24.5-26.25 km.

As for the ozone averages the data of the first half of each month (calendar days 1 - 15) and the second half (calendar days 16 - 31) are averaged for selected tangent heights into geo-location bins of 10 degrees longitude and 5 degrees latitude. The binning algorithm used is the same as the described in 8.2.3. The corresponding error is averaged as well. Figures 8-39 and 8-40 show the results for the months of July and August 2010 respectively.

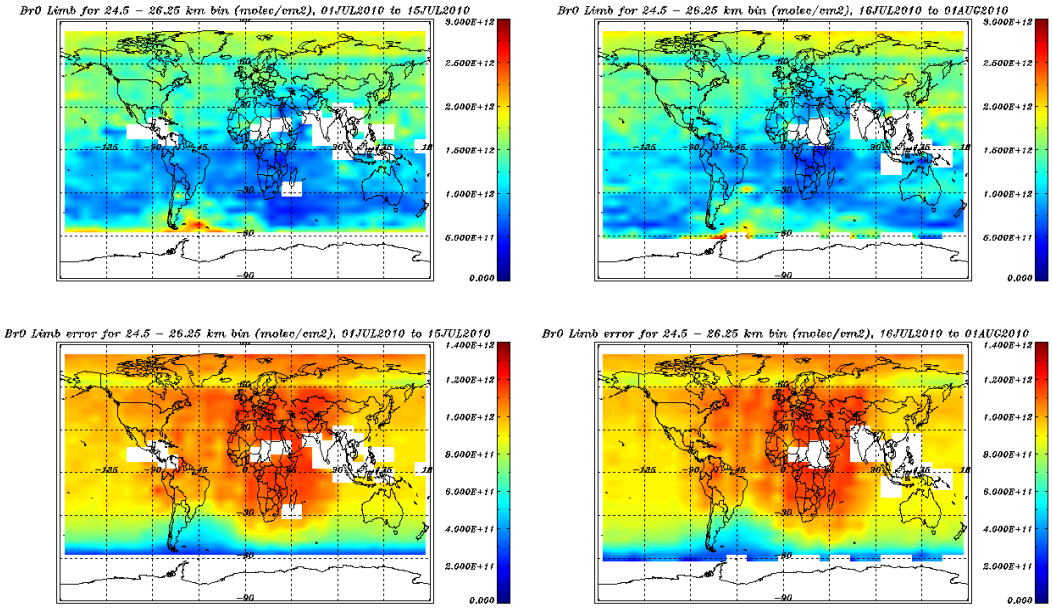


Figure 8-39: Limb BrO profiles binned over 24.5 – 26.25 km, July 2010.

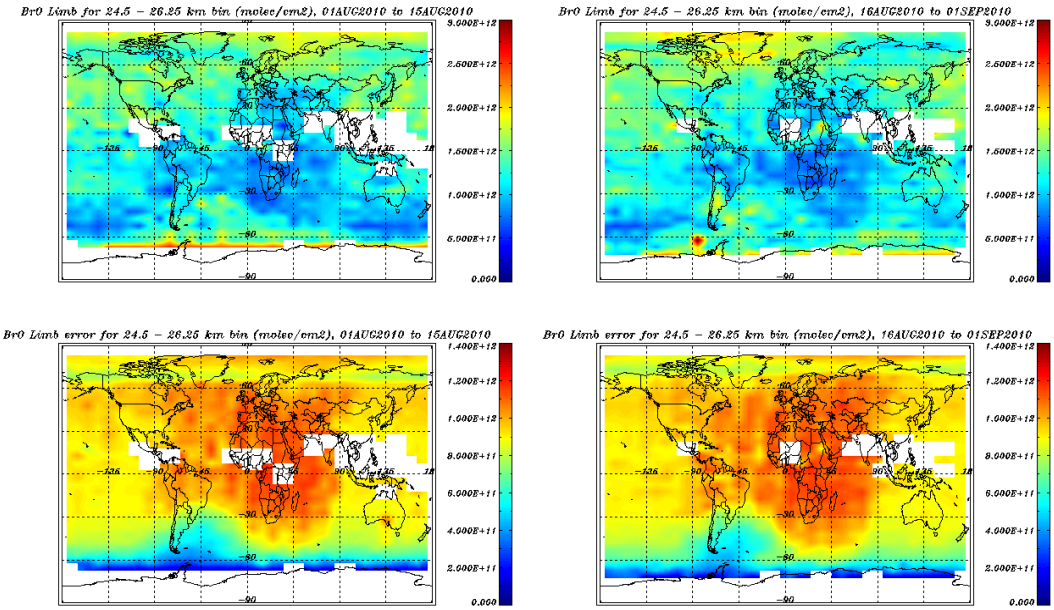


Figure 8-40: Limb BrO profiles binned over 24.5 – 26.25 km, August 2010.

9 VALIDATION ACTIVITIES AND RESULTS

Validation activities of products from re-processing with Level 1b IPF 7.03 and Level 2 off-line processor 5.01 are on-going. A first validation meeting organised by SCIAVALIG has taken place on 06-07 September 2010. While most of the new and updated geophysical parameters retrieved show very good quality, the retrieval of CO and SO_2 has resulted unreliable in their current implementation. As a consequence the Level 2 reprocessing has been interrupted.

The Product Quality Disclaimers, describing data quality and known issues, will be soon updated with the results from the validation activity. It is recommended users to not use the SO_2 and CO data sets, also with BrO data for year 2002 due to low quality.

Validation was done on the basis of the SCIAMACHY validation dataset and the forward processed data. The dataset covers selected orbits identified by the core validation teams for the complete mission until 2010 with around 1900 orbits total.

The quality of the SCI_OL__2PU data re-processed with off-line processor version 5.01 has been checked and can be viewed via the daily Level 2 reports that are available at http://earth.eo.esa.int/pcs/envisat/sciamachy/reports/daily/Level_2/

Validation of products from the previous re-processing campaign (Level 1 IPF 6.03 and Level 2 off-line processor 3.01) was performed by the SCIAMACHY Validation and Interpretation Group (SCIAVALIG). Results are published at

http://www.sciamachy.org/validation/documentation/technotes/SCIAVALIG/Summary_operational_product_quality_20080326.pdf